WATERSHED PLAN

AND

ENVIRONMENTAL IMPACT STATEMENT

DOYLE CREEK WATERSHED

HARVEY AND MARION COUNTIES, KANSAS

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HARVEY AND MARION COUNTIES, KANSAS

Abstract:

This document describes a plan consisting of six floodwater retarding dams. Alternatives considered during planning include: no-project action, a national economic development plan, a non-structural plan, and a water quality plan. Sponsors are responsible for 19.0 percent of the installation costs. Environmental impacts include: reduced sedimentation, reduced flood damages, reduced flood plain scour, decreased terrestrial wildlife habitat, increased aquatic reservoir habitat, decreased stream aquatic habitat, increased wildlife habitat quality as a result of forestland treatment, and improved water quality associated with sediment and phosphorus reductions. Sediment delivered to the John Redmond Reservoir located about 65 miles downstream from Doyle Creek's confluence will be reduced. Forestland habitat losses will be fully compensated.

This document is pursuant to authorization under Public Law 566 funding and to fulfill requirement of the National Environmental Policy Act.

This Plan/EIS has been prepared under the authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended (16 USC 1001-1008) and in accordance with section 102(2)(C) of the National Environmental Policy Act of 1969, Public Law 91-190, as amended (42 USC 4321 et seq.).

Prepared by: Doyle Creek Watershed Joint District No. 86, Kansas
Harvey County Conservation District, Kansas
Marion County Conservation District, Kansas
Kansas Department of Wildlife and Parks
Kansas Department of Health and Environment
U.S. Department of Agriculture, Soil Conservation Service
U.S. Department of Agriculture, Forest Service and Kansas State and Extension Forestry

For additional information contact: James N. Habiger, State Conservationist, Soil Conservation Service, 760 South Broadway, Salina, Kansas 67401. Phone: (913) 823-4565.

WATERSHED AGREEMENT

between the

Doyle Creek Watershed Joint District No. 86
Harvey County Conservation District
Marion County Conservation District

(referred to herein as sponsors)

State of Kansas
and the
Soil Conservation Service
United States Department of Agriculture

(referred to herein as SCS)

Whereas, application has heretofore been made to the Secretary of Agriculture by sponsors for assistance in preparing a plan for works of improvement for the Doyle Creek Watershed, State of Kansas, under the authority of the Watershed Protection and Flood Prevention Act (16 U.S.C. 1001-1008); and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to SCS; and

Whereas, there has been developed through the cooperative efforts of the sponsors and SCS a plan for works of improvement for the Doyle Creek Watershed, State of Kansas, hereinafter referred to as the watershed plan-environmental impact statement, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Secretary of Agriculture, through SCS, and the sponsors hereby agree on this plan and that the works of improvement for this project will be installed, operated, and maintained in accordance with the terms, conditions, and stipulations provided for in this watershed plan and including the following:

1. The sponsors will acquire, with other than P.L. 566 funds, such land rights as will be needed in connection with the works of improvement. (Estimated cost $238,300)

2. The sponsors hereby agree that they will comply with all of the policies and procedures of the Uniform Relocation Assistance and Real Property Acquisition Policies Act (42 U.S.C. 4601 et. seq. as implemented by 7 C.F.R. Part 21) when acquiring real property interests for this federally assisted project. If the sponsor is legally unable to comply with the real property acquisition requirements of the Act, it agrees

that, before any federal financial assistance is furnished, it will provide a statement to that effect, supported by an opinion of the chief legal officer of the state containing a full discussion of the facts and law involved. This statement may be accepted as constituting compliance. In any event, the sponsor agrees that it will reimburse owners for necessary expenses as specified in 7 C.F.R. 21, 1006(c) and 21.1007.

The cost of relocation payments in connection with the displacements under the Uniform Act will be shared by the sponsors and SCS as follows:

	Sponsors (percent)	SCS (percent)	Estimated Relocation Payment Costs (dollars)
Relocation Payments	19.0	81.0	0 a/

a/ Investigation of the watershed project area indicates that no displacements will be involved under present conditions. However, in the event that displacement becomes necessary at a later date, the cost of relocation assistance and payments will be cost shared in accordance with the percentages shown.

3. The sponsors will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.

4. The sponsors will obtain all necessary federal, state, and local permits required by law, ordinance, or regulation for installation of the works of improvement.

5. The percentages of construction costs to be paid by the sponsors and by SCS are as follows:

Works of Improvement	Sponsors (percent)	SCS (percent)	Estimated Construction Costs (dollars)
6 Floodwater Retarding Dams	0	100	1,360,800

6. The percentages of the engineering services costs to be borne by the sponsors and SCS are as follows:

Works of Improvement	Sponsors (percent)	SCS (percent)	Estimated Engineering Service Costs (dollars)
6 Floodwater Retarding Dams	0	100	476,100 *

* Construction inspection costs are included and are estimated at $272,200. The sponsors and the SCS will bear the cost of construction inspection that each incurs.

7. The sponsors and SCS will each bear the costs of project administration that each incurs, estimated to be $8,600 and $204,100, respectively.

8. The sponsors will obtain agreements from owners of not less than 75 percent of the land above each floodwater retarding dam. These agreements state that the owners will carry out conservation farm or ranch plans on their land and ensure that 75 percent of the land is adequately protected before construction of any dam.

9. The sponsors will provide assistance to landowners and operators to ensure the installation of the land treatment measures shown in the watershed plan.

10. The sponsors will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

11. The sponsors agree to participate in and comply with applicable federal flood plain management and flood insurance programs before construction starts.

12. The sponsors will be responsible for the operation, maintenance, and replacement of the works of improvement by actually performing the work or arranging for such work, in accordance with agreements to be entered into before issuing invitations to bid for construction work.

13. The costs shown in this plan are preliminary estimates. Final costs, to be borne by the parties hereto, will be the actual costs incurred in the installation of works of improvement.

14. This agreement is not a fund-obligating document. Financial and other assistance to be furnished by SCS in carrying out the plan is contingent upon the fulfillment of applicable laws and regulations and the availability of appropriation for this purpose.

15. A separate agreement will be entered into between SCS and sponsors before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

16. This plan may be amended or revised only by mutual agreement of the parties hereto, except that SCS may deauthorize or terminate funding at any time it determines that the sponsor has failed to comply with the conditions of this agreement. In this case, SCS shall promptly notify the sponsor in writing of the determination and the reasons for the deauthorization of project funding, together with the effective date. Payments made to the sponsor or recoveries by SCS shall be in accord with the legal rights and liabilities of the parties when project funding has been deauthorized. An amendment to incorporate changes affecting a specific measure may be made by mutual agreement between SCS and the sponsor(s) having specific responsibilities for the measure involved.

17. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this plan, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

18. The program conducted will be in compliance with all requirements respecting nondiscrimination, as contained in the Civil Rights Act of 1964, as amended, and the regulations of the Secretary of Agriculture (7 CFR 15), which provide that no person in the United States shall on the grounds of race, color, national origin, sex, age, handicap, or religion, be excluded from participation in, be denied the benefits of, or otherwise be subjected to discrimination under any program or activity conducted or assisted by the Department of Agriculture.

Doyle Creek Watershed Joint District No. 86
Local Organization

By Robert Sellers
Robert Sellers

Title President

P.O. Box 31, Peabody, KS 66866
Address Zip Code

Date February 18, 1992

The signing of this agreement was authorized by a resolution of the governing body of the DOYLE CREEK WATERSHED JOINT DISTRICT NO. 86
Local Organization

adopted at a meeting held on February 18, 1992

Randall Windsor
Randall Windsor
Secretary

P.O. Box 31, Peabody, KS 66866
Address Zip Code

Date February 18, 1992

Harvey County Conservation District
Local Organization

By Robert L. Friesen
Robert L. Friesen

Title Chairman

1405 South Spencer, Newton, KS 67114
Address Zip Code

Date March 2, 1992

The signing of this agreement was authorized by a resolution of the governing body of the HARVEY COUNTY CONSERVATION DISTRICT
Local Organization

adopted at a meeting held on March 2, 1992

Carol Hiebert
Carol Hiebert
Secretary

1405 South Spencer, Newton, KS 67114
Address Zip Code

Date March 2, 1992

Marion County Conservation District
Local Organization

By Dennis Youk
Dennis Youk

303 Eisenhower Dr.
Marion, Kansas 66861
Address Zip Code

Title Chairman

Date February 18, 1992

The signing of this agreement was authorized by a resolution of the governing body of the MARION COUNTY CONSERVATION DISTRICT
Local Organization

adopted at a meeting held on February 18, 1992

Betty Richmond
Betty Richmond
Secretary

Marion, Kansas 66861
Address Zip Code

Date February 18, 1992

Soil Conservation Service
United States Department of Agriculture

Approved by:

James N. Habiger
James N. Habiger
State Conservationist

3/31/92
Date

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SUMMARY OF WATERSHED PLAN/ENVIRONMENTAL IMPACT STATEMENT

PROJECT NAME: Doyle Creek Watershed

COUNTIES : Harvey and Marion **STATE** : Kansas

SPONSORS : Doyle Creek Watershed Joint District No. 86
Harvey County Conservation District
Marion County Conservation District

DESCRIPTION OF NED PLAN:

The NED plan includes six floodwater retarding dams and forestry land treatment on 1,560 acres. This plan was formulated for the reduction of floodwater damages; therefore, water quality benefits are secondary to the primary purpose. The forestland will be treated and managed for long-term streambank stabilization, water quality, and incidental benefits to wildlife habitat, timber, and wood products. Primary emphasis will be on riparian forest buffer strips.

RESOURCE INFORMATION:

Size of Watershed 89,410 acres

Land Ownership	Percent
Private	97.6
Federal and State Transportation System	0.5
Local Public Transportation System	1.2
Urban	0.7

Number of Farms - 310 Average Size - 288 acres

Number of Minority Farmers - none

Number of Limited Resource Farmers - 12

Important Farmland - 50,960 acres prime farmland

Highly Erodible Cropland - 11,350 acres

Wetlands - Minor acres as inclusive within other land uses.

Endangered and Threatened Species - Federally-listed species which may occur include the piping plover, least tern, bald eagle, peregrine falcon, Eskimo curlew, and whooping crane.

State-listed species that could occur are the snowy plover, eastern hognose snake, eastern spotted skunk, and white-faced ibis.

The Neosho madtom is listed on both state and federal endangered species lists. It is not present within the watershed but occurs in downstream Cottonwood River reaches. There is concern about how watershed impoundments will affect flow volumes and flood surges. The Neosho madtom is dependent upon the presence of clean deposits of gravel. Alteration of flows within the Cottonwood may impact gravel transport, sediment accumulation, and existing invertebrate populations which provide food for the Neosho madtoms.

Cultural Resources - No significant sites identified that would be affected by the project.

LAND USE:

Present Land Use	Total Watershed		100-Year Flood Plain	
	Acres	Percent	Acres	Percent
Cropland	42,580	47.6	4,220	74.2
Grassland	38,090	42.6	210	3.6
Forestland	2,750	3.1	970	17.1
Other Land	5,990	6.7	300	5.1
Total	89,410	100.0	5,700	100.0

PROBLEM IDENTIFICATION:

Problems identified in the watershed are flood damages, moderate sheet and rill erosion, ephemeral gully erosion, and impaired water uses. Watershed streams are impaired for aquatic life and contact and non-contact recreation.

Annual flood damages to the 5,700-acre flood plain are: (1) crop and pasture, $131,000; (2) other agricultural, $64,900; (3) scour, $7,300; (4) roads and bridges, $4,200, (5) railroads, $9,700, and (6) urban, $18,700.

Sheet and rill erosion damages are estimated from untreated cropland after application of the 1985 Food Security Act treatment. About 10,800 acres are affected at an erosion cost of $39,600 per year.

Ephemeral gully erosion damage on 94 acres (voids) depreciate the production potential on another 807 acres. Damages are estimated to be $23,800 each year.

Non-point source (NPS) pollutants impair watershed streams' use for aquatic life and contact and non-contact recreation. The NPS pollutants are phosphorus, suspended solids (primarily soil), organic matter, and fecal bacteria.

Removal of riparian timber has left denuded stream banks and single rows of trees in some stream sections. This condition prohibits the riparian timber to function as a filter strip, stabilize stream banks, and provide wildlife habitat. In addition, over-mature timber stands and timber stands subject to abusive livestock grazing practices lack vigor and are less able to remove excess nutrients from the surface and ground water.

CANDIDATE PLANS CONSIDERED:

Alternatives considered included a no-project action plan, primarily non-structural plan, NED plan, and a water quality plan. The NED plan was formulated through an incremental analysis. The water quality plan was formulated to meet Kansas water quality standards. See Selected References No. 3, page 85.

PROJECT PURPOSES:

The project purposes include watershed protection, flood prevention, and improved water quality.

PRINCIPAL PROJECT MEASURES:

6 floodwater retarding dams
1,560 acres forestry land treatment

PROJECT COSTS:

	P.L. 566 Cost		Other Funds		Total
	$	%	$	%	$
Land Treatment Measures:					
Forestry	0	0	231,400	100.0	231,400
Technical Assistance	46,900	80.0	11,700	20.0	58,600
Structural Measures					
Floodwater Retarding Dams	1,360,800	85.1	238,300	14.9	1,599,100
Technical Assistance	476,100	100.0	0	0	476,100
Project Administration	204,100	96.0	8,600	4.0	212,700
Total	2,087,900	81.0	490,000	19.0	2,577,900

PROJECT BENEFITS IN DOLLARS:[a/]

	Value	Percent
Agricultural	168,600	56.8
Roads, Bridges, and Railroads	37,100	12.5
Urban	33,500	11.3
Water Quality	24,600	8.3
Forestry Land Treatment	32,800	11.1
Total	296,600[b/]	100.0

a/ Price base 1990
b/ Off-project benefits amount to 60.3 percent or $179,000.

Acres Benefited: Watershed Total 7,260 - Land Treatment 1,560, Structural 5,700
Cottonwood River 50,000 flood plain

IMPACTS:

Land Use Changes - 6 Floodwater Retarding Dams

Converted from (ac.):		Converted to (ac.):	
		Dam[a/]	Sediment Pool
Cropland	102	18	84
Grassland	196	32	164
Forestland	37	15	22
Total	335	65	270

a/ Dam and spillway areas seeded to a native grass mixture and managed for wildlife

NATURAL RESOURCES CHANGED OR LOST:

Wetlands (ac.) - small area created and a small area converted to water; net effect essentially equal

Cultural Resources (name) - none

Wildlife Habitat -

	Loss Before Compensation	Compensation	Net Compensation
Forestland (HU)*	272.0	272	0
Herbaceous (HU)	1,171.9	650	-521.9

Fisheries - Change of 2.6 miles of intermittent stream and 2.4 miles of perennial stream to reservoirs and enhance the fishing potential of about 17 miles below dams by about 220 recreational

* Habitat units equal the rated quality value (variable 1 to 10) multiplied by acres

visitor days per year. Fish species expected to increase are channel catfish, sunfish, bullheads, bass, crappie, and carp. Spotted bass, log perch, and longear sunfish that do not provide a sport fishery may be affected in the permanent pool areas where these populations presently exist.

Farmers will likely stock the floodwater retarding dams with bass and channel catfish for private use. No project benefits are claimed for this private fishery but project benefits are claimed for 17 miles of Doyle Creek's 60-mile perennial stream.

This reduction of sediment and phosphorus will reduce algae blooms and increase stream aesthetics. More uses will be made of the streams other than fishing.

MAJOR CONCLUSIONS:

1. The National Economic Development (NED) plan provides watershed protection, flood prevention, and improved water quality within the watershed. In itself, the plan does not meet the state water quality standards established for the watershed. The plan does provide, however, a major element of the state non-point source (NPS) pollution management plan that will result in the watershed meeting the state water quality standards.

2. The U.S. Fish and Wildlife Service (F&WS) prepared a biological opinion as a part of the consultation process that stated that the project would have no jeopardy on the Neosho madtom species or its habitat. The Neosho madtom has been found in the Cottonwood River, about 60 miles below the outlet of the Doyle Creek Watershed. The F&WS's biological opinion also stated the species and effects monitoring should be done in South Fork Watershed, a watershed located downstream from Doyle Creek.

   SCS prepared a biological assessment for the Cottonwood River Basin, as part of the threatened and endangered species consultation process, that concluded Doyle Creek Watershed would not adversely affect the Neosho madtom.

AREAS OF CONTROVERSY:

During interagency review some reviewers questioned why the water quality plan was not selected. Others suggested including more water quality features in the selected plan.

The recommended plan is only one element of the state's multi-program non-point source pollution control plan. By including the PL-566 dams, the state NPS plan will contain land treatment measures, state-funded dams, six PL-566 dams, and treatment of confined livestock feeding operations. Water quality concerns will be satisfied through adoption and implementation of this NPS plan.

ISSUES TO BE RESOLVED:

SCS has agreed to cooperate with the F&WS and the Kansas Department of Wildlife and Parks (KDW&P) to accomplish project effects monitoring for the Neosho madtom in South Fork Watershed. The F&WS believes that the monitoring should be done by a private consultant at the expense of SCS or the sponsoring local organization rather than cooperatively with each agency using its own resources. Section 12 of the Watershed Protection and Flood Prevention Act stipulates that "The cost of making surveys and investigations and of preparing reports concerning the conservation and development of wildlife resources shall be borne by the Secretary of the Interior out of funds appropriated to his Department." The extent of monitoring and how it will be accomplished is yet to be resolved.

INTRODUCTION

The watershed plan and environmental impact statement have been combined into a single document describing plan formulation and expected environmental impacts; and is the basis for authorizing federal assistance for implementation.

This watershed is part of the Arkansas-White-Red River Basin. The flood control works of improvement will have an effect on Doyle Creek and Cottonwood River flood plains. The project will have a significant water quality effect.

The USDA's Soil Conservation Service (SCS) and Forest Service (FS), Kansas State and Extension Forestry, Kansas State Conservation Commission, Kansas Department of Wildlife and Parks, and the Kansas Department of Health and Environment assisted the local sponsors in developing the plan. Other federal, state, and local agencies also assisted by providing information, reviewing data, and helping with assessments.

The plan was prepared under the authority of the Watershed Protection and Flood Prevention Act, Public Law 566 (83d Cong., 68 Stat. 666), as amended (16 USC 1001-1008), and in accordance with Section 102(2)(C) of the National Environmental Policy Act of 1969 (NEPA), Public Law 91-190, as amended (42 USC 4321 et seq.). The Soil Conservation Service is responsible for compliance with the National Environmental Policy Act.

PROJECT SETTING

Doyle Creek Watershed is located in central Kansas and contains 89,410 acres or 139.70 square miles with 13,930 acres in Harvey County and 75,480 acres in Marion County. The watershed is about 5 miles north of the city of Newton and 35 miles north of the city of Wichita.* The watershed is in the Arkansas-White-Red River Basin which has a national hydrologic unit number of 11070202030. The drainage originates in southwestern Marion County and flows southeasterly through the northeast corner of Harvey County and then northeasterly through Marion County to its confluence with Cottonwood River at Florence, Kansas. The highest watershed elevation is 1,567 feet and the lowest elevation is about 1,260 feet for a total relief of 307 feet.

A map of the Cottonwood River Basin shows the relationship of Doyle Creek to the other watersheds. Off-project benefits are identified from the Doyle Creek confluence to John Redmond Reservoir. See Cottonwood River Basin Map, Appendix B.

Gently rolling hills and narrow stream valleys falling as much as 200 feet in five miles are typical of the western reaches of Doyle Creek. These fan-type drainages concentrate runoff and cause severe and frequent flooding but usually of short duration. Out-of-bank flow occurs two to three times per year from six to twelve hours at a time.

Most of the western uplands are covered by soils of the Irwin-Clime-Rosehill association. These deep and moderately deep soils have clayey subsoils. The more sloping areas in the eastern one-third of the watershed have soils of the Tully-Sogn-Labette association. These deep to shallow soils are formed from weathered shale and limestone. The uplands in the southeast and north central parts of the watershed are covered by soils of the Irwin-Ladysmith association. These nearly level to moderately sloping soils have dense clayey subsoils. The Wells-Verdigris soil association is located along Doyle Creek from Peabody to Florence. These loamy soils are on foot slopes and flood plains along the creek. 1/**

* All information and data, except as otherwise noted by reference to source, were collected during watershed planning investigations by the Soil Conservation Service and the Forest Service, U.S. Department of Agriculture.

** Numbers appearing in the text correspond to numbers listed in Selected References, page 85.

Watershed land use consists of 48 percent cropland, 43 percent grassland, 3 percent woodland, and 6 percent other land. There are approximately 11,350 acres of highly erodible cropland or 13 percent of the watershed.

The watershed lies in the path of alternate masses of warm, moist air moving north from the Gulf of Mexico and currents of cold, comparatively dry air moving south from the polar regions. Therefore, the area is subject to frequent and abrupt weather changes. High intensity thunderstorms of short duration are common and often cause flash floods. The watershed is also subject to extended periods of below normal rainfall with resulting drought conditions. Annual precipitation averages 31 inches but has varied from approximately 19 to 44 inches. Seventy percent of the annual rainfall occurs during the 183-day growing season. Average annual temperature is 56 degrees F.

The 1980 watershed population was about 2,400 persons. Peabody, population of 1,470, and Florence, population of 730, are the only towns in the watershed. The balance of the 1980 population was rural. 2/

Farm numbers have been decreasing about one percent per year. There were approximately 310 farms in 1988. Most of the farms are diversified. Wheat, grain sorghum, soybeans, alfalfa, and corn are the principal cultivated crops. Wheat and soybeans are sold as cash crops while feed grains are generally marketed through livestock.

Major highways serving the watershed are U.S. Highways No. 50 and No. 77. Kansas Highway No. 15 is west of the watershed. A system of county roads serves rural areas and connects federal and state highways. The Atchison, Topeka, and Santa Fe and the Pacific railroads both serve the watershed.

PROBLEMS AND OPPORTUNITIES

FLOODWATER DAMAGE

Floodwater damages crops by washing out plants, covering them with trash or sediment, and/or affecting the normal growth patterns. Damage caused by early season floods often requires fields to be retilled and crops replanted. Fertilizers and herbicides are lost; therefore, additional fertilizers and herbicides are applied during replanting.

Several miles of fence are destroyed or damaged even by minor floods. Feed bunks, hog pens, and stockwater storage tanks are also frequently damaged. Considerable expense is incurred cleaning up debris after floods.

Flood plain roads and bridges sustain damage. Floods wash away road surfacing, scour road shoulders, fill roadside ditches with sediment, and damage bridges structurally. Floods cause inconvenience to all residents in the area. Near Peabody, traffic using U.S. Highway No. 50, an important east/west highway, must detour around flooded areas.

The 100-year flood plain includes about 5,700 acres. Eleven major bridges span Doyle Creek and its tributaries. There are about 3.3 miles of dirt, gravel, and asphalt roads on the flood plain. There are approximately 3.8 miles of railroad track on the flood plain that are over topped by the 100-year flood. Another 4.5 miles of railroad tracks parallel the flood plain but are not inundated.

Table A - Average Annual Flood Damages by Reach
Dollars a/

Reach	100-year Flood Plain	Crop and Pasture	Other Agri.	Road	Rail-road	Scour	Urban	Total
1	1,105	19,000	18,000	400		1,700		39,100
2	876	10,800	3,600	400		1,300		16,100
3	1,256	33,300	9,500	300	4,500	1,500		49,100
4	333	2,800	1,000	400	100	500		4,800
5	1,153	32,400	27,100	2,100	5,100	1,400	18,700	86,800
6	977	32,700	5,700	600		900		39,900
Total	5,700	131,000	64,900	4,200	9,700	7,300	18,700	235,800

a/ Price base 1990 and 1990 current normalized prices for crop and pasture.

Floods have occurred in every month of the year but are more common during the summer months. The flood distribution is as follows: January, <1 percent; February, 2 percent;

March, 7 percent; April, 11 percent; May, 17 percent; June, 24 percent; July, 12 percent; August, 5 percent; September, 10 percent; October, 8 percent; November, 3 percent; and December, 1 percent. The month that has the greatest probability of flooding is June.

Florence and Peabody city limits extend into the flood plain. The city of Florence is on the common flood plains of the Cottonwood River and Doyle Creek. Except for the railroad and grain elevator, the city of Florence is protected by a Corps of Engineers' levee to the 500-year frequency flood.

Grain elevators, fertilizer storage tanks, bulk fertilizer warehouses, businesses, and private homes are subject to flood damages at Peabody. Twenty-two homes ranging in value from $3,000 to $50,000 are located on the flood plain. Floodwater has reached five to six feet of depth in some homes. The risk of loss of life exists. Twelve businesses and/or buildings are subject to flood damages. These include two general office buildings, two auto and general repair shops, two senior citizen's buildings, one cafe, a bowling alley, one barber shop, one video store, one laundry, and an American Legion Post building.

The local sheriff and others watch high intensity storms closely to assess the flooding potential at Peabody. When flooding is imminent, the local people warn potential flood victims immediately to prepare for a flood and for possible evacuation. Those aware of potential flood damages elevate beds, couches, televisions, and other personal belongings above known flood elevations. New residents unfamiliar with past floods are generally vulnerable to the full flood impact.

About 100 acres of Peabody city limits are on the flood plain at the 100-year elevation. Florence is protected by the Corps of Engineers' levee.

During floods and immediately following, watershed residents are limited in the number of roads that they can use to safely cross Doyle Creek. This causes inconvenience and increases the risk of loss of life.

Table B - Flood Damages by Flood Frequency

Type	2-year	10-year	50-year	100-year
Agricultural				
Crop and Pasture				
Total Damages ($)	62,800	251,500	358,000	371,300 a/
Acres Flooded (ac.)	(1,440)	(3,640)	(4,500)	(4,600)
Other (farms, fences, etc.)				
Total Damages ($)	14,300	148,200	330,000	359,700
Subtotal Damages ($)	77,100	399,700	688,000	731,100
Roads, Bridges, and Utilities				
Total damages ($)	3,500	28,300	120,000	132,800
Urban				
Total Damages ($)	2,100	48,800	115,000	123,500
TOTAL ALL DAMAGES ($)	82,700	476,800	923,000	987,300

a/ Total flood plain of 5,700 acres includes crop and pasture land, 4,430 acres; woodland, 970 acres; stream channel, 170 acres; and miscellaneous land, 130 acres.

About 50,000 acres of the Cottonwood River flood plain are subject to flooding below the Doyle Creek confluence. Sources of information, evaluation methods, and percent distribution of main stem flood damage reduction benefits to watersheds are discussed in Appendix C. Cottonwood River flood damages and flood damage reduction benefits are quantified in Table 5.

SOIL DEPLETION

The thin, fragile soils are more difficult and less efficient to raise crops on once the topsoil is lost. Fertilizer and tillage costs increase to maintain crop yields. Subsoils are higher in clay content which restricts the water intake rate. Natural water courses on cropland wash away large volumes of topsoil. These ephemeral drains range between two and six feet in width and erode to a maximum tillage depth of two to six inches, especially during severe storms when little or no plant cover exists.

Long-term soil losses are estimated to be $39,600 per year. Yearly erosion (now time) damages are estimated to be $22,400. Ephemeral erosion damage is estimated to be $23,800. Loss of top soil severely limits the water infiltration rate and water holding capacity of the soil. The allowable soil losses for the watershed soils are three to five tons per acre per year based on individual soil characteristics. Untreated cropland soils generally exceed this soil loss.

Table C - Sheet and Rill Erosion
Future Without - Untreated Cropland Acres Only

Reach	Acres	Tons/Acre	Tons Erosion
1	3,606	5.0	18,030
2	1,438	4.5	6,470
3	960	5.3	5,090
4	1,683	4.8	8,080
5	1,455	5.7	8,290
6	2,603	5.0	13,000
Total	11,745	5.0	58,960

Ephemeral erosion causes extra tillage and harvesting costs. When the soil surface is exposed, more surface water is collected in natural water courses and conveyed off the field. Field slopes tend to be rather long and flat. As a consequence, ephemeral water courses are relatively long and wide. Farmers plow in these drains or double disk adjacent cropland and replant in an attempt to keep the field productive. If a runoff event occurs relatively soon, the loose soil is flushed out and lost.

Table D - Ephemeral Acres and Tons Soil Loss
Future Without - Cropland

Reach	Untreated Cropland Ac.	Voided Ac.	Depreciated Ac.	Tons per/year	Ephemeral Length in Feet
1	3,606	16.1	138	6,300	200,400
2	1,438	20.8	178	8,100	258,900
3	960	4.8	41	1,900	59,700
4	1,683	13.9	119	5,500	173,000
5	1,455	16.6	142	6,500	206,600
6	2,603	22.0	189	8,600	273,800
Total	11,745	94.2	807	36,900	1,172,400

SEDIMENT DEPOSITION

John Redmond Reservoir has been filling with sediment faster than the design estimate. If sediment control measures were constructed up stream, the sedimentation could be reduced. The sediment is reducing the amount of beneficial storage available for flood control, recreation, water supply, fish and wildlife, and water quality. John Redmond Reservoir

was designed to contain 55,000 acre feet of sediment. At the current rate of sedimentation, sediment storage will be exceeded before the design life and deposition will begin to occupy storage provided for other beneficial reservoir water uses.

WATER QUALITY

Surface water quality was monitored on various tributaries within and at the outlet of the watershed. Kansas Department of Health and Environment (KDHE) summarized this monitoring in the Doyle Creek Water Quality Preliminary Assessment. 3/ A summary of the findings are noted in Table E. Non-point source (NPS) pollutants impair watershed streams' use for aquatic life and contact and non-contact recreation. Common NPS pollutants are phosphorus, suspended solids (primarily soil), organic matter, and fecal bacteria. Pesticides (atrazine and alachlor) were detected but were well below standards. The source of phosphorus and suspended solids is eroding cropland and grassland. Confined feeding areas are believed to be the major source of fecal bacteria and nitrates.

The quality of water from wells throughout the watershed was inventoried and documented in the 1991 assessment. Approximately 33 percent of the wells tested have concentrations of nitrates that exceed the drinking water standard. Water hardness is a problem for three-fourths of the wells. A few of the wells contained fecal bacteria. These percentages were similar to percentages obtained from non-project sampling of ground water throughout Marion County. The hardness and concentration of nitrates appear to be due to natural causes. High fecal bacteria concentrations appear to be due to the physical condition of the wells and to the proximity of the well to confined livestock feeding areas.

Table E shows the relationship between water samples tested in 1989 compared to the state's standard. Nitrate (N[Mg/L]) exceeded the state's standard as did phosphorus, suspended solids, fecal coliform, and BOD. Atrazine and alachlor were detected during testing but were below the state's standard. 3/

Table E - Doyle Creek Water Quality Summary[a/]

Contaminant	Unit	Baseflow Concentrations[b/]	Runoff Concentration[c/]	Mean Concentration[d/]	Water Quality Standard
Nitrate	mg/l	1.47	0.78	1.38	1.20
Phosphorus	mg/l	0.076	1.35	0.24	.10
Suspended Solids	mg/l	22	1,700	240	100
Fecal Coliform	#/100ml	110	76,500	9,800	200/2,000[e/]
BOD	mg/l	3.2	12.2	4.3	3.0
Atrazine	ug/l	< 1.2	8.7	1.6	3.0
Alachlor	ug/l	<0.25	0.58	0.18	0.50

a/ Data collected from four sample sites
b/ Mean of eight observations
c/ Mean of five observations
d/ Weighted mean assuming 88 percent baseflow and 12 percent runoff flow
e/ Low flow and high flow concentration levels

FORESTLAND

Riparian forest buffer strips are not being fully utilized. Repeated harvesting of only the best trees has caused these strips to deteriorate to low-value cull and weed trees--frequently of low vigor. Productive, vigorous stands of trees are not being maintained; therefore, water quality benefits and potential economic benefits to landowners are not being realized. Without realizing the economic potential, farmers may destroy more of the riparian buffer strips at the expense of water quality.

Failure to harvest in a timely fashion has resulted in gradual decline in productivity, growth, and vigor. Over-mature stands lack vigor and are less able to provide uptake of nutrients. Salvage and/or sanitation harvesting are needed to restore vigor and species balance which have water quality and wildlife benefits as well as providing economic returns to the landowners.

Single rows of trees are common and lack the ability to provide filtering benefits for non-point source pollution as well as long-term streambank stabilization and significant wildlife habitat.

Destructive grazing leads to lack of forest reproduction, inadequate ground cover, and soil compaction which greatly diminishes the absorption qualities of forested soils. Livestock watering and feeding in the riparian forest zone also can contribute to water quality problems by providing for direct entry of livestock wastes into the stream. Along the mainstem of Doyle Creek, most of the flood plain forests are not grazed or grazed only moderately, but the riparian zones on the tributaries and upper reaches of Doyle Creek are much more subject to destructive grazing.

WATERSHED STREAMS

In a Kansas stream survey conducted in 1975 and 1976, Doyle Creek stream fishing was limited to the mainstem between Peabody and Florence. This survey indicated a yearly use of 575 angler days per year for a stream length of 17 miles which represents 33.8 angler days per mile/per year. Similar streams reported more use than Doyle Creek; therefore, potential stream fishing is not being realized. Doyle Creek has the potential to provide more fishing opportunities. Sediment loads, high nutrient levels, and high fecal bacteria limit the pounds of fish as well as reduce the aesthetic values. This stream could double or triple angler days over present use.

INVENTORY AND FORECASTING

SCOPING OF CONCERNS

Doyle Creek Watershed District was incorporated as a legal organization in Kansas for two purposes: to reduce flood damages and to provide watershed protection. The District published a General Plan in 1975 which gave an estimate of flood damages within the watershed and potential dams that could be built to reduce flooding within the watershed and the Cottonwood River. This plan listed several dam locations with dam height, cubic yards of fill, and construction cost estimates. The General Plan was a basis for SCS to begin providing technical planning assistance.

The General Plan listed twenty-two dam site locations. Of these, 15 were identified for potential PL-566 funding and 7 were identified for state and local funding. Before the Pre-authorization Report was completed, the district had constructed Dam Nos. 7, 8, and 105 and had designed Dam No. 104. These four dams were included in future without project conditions. The remaining 18 dams and Dam Nos. 16, 17, and 18 were analyzed to determine whether they could be included in the selected plan. An explanation of how these dams were tested incrementally is in Appendix C, Investigation and Analysis Report, Hydrology.

Dam Nos. 7, 8, and 105 are located on each major drainage between Dam Nos. 6 and 9 beginning with Dam No. 105 next to Dam No. 6 then 7 and 8, respectively. Dam No. 104 is located east of Dam No. 5 in section 19, range 3 east, township 22 south. Construction has since been completed for Dam No. 104.

As part of the PL-566 planning process, the watershed district board considered other community concerns besides flooding. At the August 22, 1989, watershed board meeting, a list of water resource concerns, degree of impact, significance to decision making, and remarks was prepared.

In February 1990 the watershed district board's list of concerns was sent to federal and state agencies for review and comment. Surface water quality rating was changed to a major concern similar to flooding. Groundwater quality was changed to a moderate concern similar to erosion. All other factors were left as the watershed board described and rated them. Table F contains the list of resource concerns and significance to decision making.

Table F - Resources and Problems Significant to Decision Making

Resource or Related Factor	Current or Projected Concern or Occurring Resource a/	Estimated Impact of System of Flood Control Dams a/	Significance to Decision Making	Remarks
Wetlands	Minor	None	Low	None affected by project
Important Agricultural Land	Major	Major	High	Threatened by erosion
Cultural Resources	Minor	Minor	Low	None known
Threatened and Endangered Species	Minor	Low	Moderate	Neosho madtom does not occur in the watershed
Visual Resources	Minor	Minor	Low	Typical rural Kansas setting with little change expected
Transportation Systems (downstream)	Major	Major	High	Damage prevention
Transportation Systems (upstream)	Minor	Minor	Medium	At dam locations
Mineral Resources	Minor	None	Low	No major pipelines. Minor oil activity
Minority Groups	Minor	Minor	Low	
Limited Resource Farmers	Moderate	Minor	Low	See county average income compared to state or national averages
Recreation	Minor	Minor	Low	Small local demand
Sheet and Rill Erosion	Moderate	Major	High	75 percent land treatment would be required above structures
Ephemeral Gully Erosion	Moderate	Major	High	75 percent required
Gully Erosion	Moderate	Moderate	Medium	Problems with shallow soil
Sedimentation	Moderate	Major	High	John Redmond Reservoir, Emporia water intake, and road ditches
Surface Water Quality	Major	Major	High	Some State water quality standards are not being met
Ground Water Quality	Moderate	Minor	Low	Wells to be monitored
Flooding	Major	Major	High	Damage reduces agricultural income
Scour	Major	Major	High	Strips flood plain of valuable topsoil.
Fisheries Habitat	Moderate	Moderate	Medium	Net increase in angling would result from project. KDW&P preliminary assessment is being developed.
Wildlife Habitat	Moderate	Moderate	High	
Domestic Water Supply	Moderate	Minor	Low	Some shortage of on-farm water
Global Warming	Minor	Minor	Low	Small beneficial effect anticipated from increased plant production

a/ Relative magnitude of resource occurrence or impact of alternatives:
Major - significant
Moderate - readily apparent and somewhat significant
Minor - detectable but slight
None - at lower level of detection if at all

EXISTING RESOURCES

The 1982 farm income for Harvey and Marion Counties was $116,761,000 which represented an average of $55,400 per farm. Thirty-one percent of the farms had farm sales of $10,000 or less and 36 percent of the farms had farm sales of $10,000 to $40,000. Nineteen percent of the farms had farm sales between $40,000 and $100,000; 11 percent between $100,000 and $250,000; and 3 percent over $250,000. 5/ Doyle Creek Watershed farms are comparable to these county averages.

Sixty-three percent of the farm operators listed farming as their principal occupation, but 35 percent of all farm operators worked 200 or more days off the farm. Forty percent of the farm operators did not work off the farm. The average farm operator was 50 years old.

The 1982 two-county farm income of $116,761,000 came from crop sales of $45,853,000 and livestock and poultry sales of $70,909,000. Wheat was the largest crop category followed by grain sorghum, soybeans, corn, and other crops.

Cattle and calf sales constituted 63 percent of livestock sales followed hogs and pigs, dairy products, poultry, and other livestock.

Harvey and Marion Counties per capita income was below the state and national average in 1987 with figures of $13,642 and $13,135, respectively, compared to $15,089 and $15,472. 6/

Transportation routes in Doyle Creek Watershed are essential to the economy. Major routes through the watershed are U.S. Highway 50 from east to west and U.S. Highway 77 going north and south at Florence. Kansas Highway 15 is near the western watershed boundary. The minor routes are gravel roads and other short sections of dry weather road which connect these highways.

The Atchison, Topeka, and Santa Fe and the Pacific railroads serve the area.

WETLANDS

Watershed wetlands are likely to occur on hydric soils or soils with hydric inclusions. These soils are considered to be areas that contain potential wetlands and are delineated on county soil surveys found in Section II of the SCS Field Office Technical Guide. The watershed has small,

isolated pockets of wetlands of a few acres. These areas are inclusions within the grassland category. 1/

LAND USE

Fifty-seven percent of the land is classified as prime farmland. Land use is shown in Table G. Stream channel, water areas, and gullies were subtracted from cropland, grassland, and forestland acres for evaluation purposes.

Table G - Present Land Use

Land Use	Evaluated Flood Plain		Upland		Total	
	Acres	%	Acres	%	Acres	%
Cropland	4,220	74.2	38,360	45.8	42,580	47.6
Grassland	210	3.6	37,910	45.4	38,120	42.6
Forestland	970	17.1	1,780	2.1	2,750	3.1
Other Land	30	0.5	3,950	4.6	3,980	4.4
Stream Channel	170	2.9	--	--	170	0.2
Water Area	--	--	1,210	1.4	1,210	1.4
Urban	100	1.7	500	0.7	600	0.7
TOTAL	5,700	100.0	83,710	100.0	89,410	100.0

WATERSHED SOILS

The western watershed soils are of the Irwin-Clime-Rosehill association. These are deep and moderately deep soils formed over weathered calcareous shales with clayey subsoils. The eastern one-third of the watershed has soils of the Tully-Sogn-Labette association. These deep to shallow soils are formed from weathered shale and limestone. The upland soils in the southeast and north-central watershed are of the Irwin-Ladysmith association. These nearly level to moderately sloping soils have dense clayey subsoils. The Wells-Verdigris soil association is located along Doyle Creek from Peabody to Florence. These loamy soils are on foot slopes and flood plains along the creek.

Soils classified as highly erodible cropland (HEL) make up 11,350 acres. Most of the watershed farmers receive USDA program financial benefits and are affected by Food Security Act regulations. Survey data indicate that about 75 percent of the treatment needed for the cropland HEL acres will be applied by 1995. The remaining acres would be untreated in the future.

DOMESTIC WATER SUPPLY

Rural water districts distribute water to most farms and ranches within the watershed for domestic use. Harvey County Rural Water District No. 1, which serves much of the area, obtains its water from the ground water within the Equus Beds. The Equus Beds aquifer is located west of the project.

The city of Peabody, located approximately in the middle of the watershed, obtains its water supply from seven or eight wells drilled into the underlying Wellington Formation bedrock. These wells extract water from both the Wellington and the overlying alluvium. The water quality and quantity from these wells is marginal but adequate at the present time.

The city of Florence, located at the extreme north-eastern corner of the watershed near the mouth of Doyle Creek, primarily obtains its water supply from springs issuing from limestone bedrock. However, the city has back-up wells available in the Cottonwood River alluvium. The water supply for Florence is good.

Some of the farmsteads in the watershed area still use private wells for domestic and agricultural purposes. A number of these wells are likely to go dry during periods of prolonged droughts. Several wells went dry during the summer of 1991.

The ground water underlying Doyle Creek Watershed is contained within both consolidated and unconsolidated aquifers. Neither medium is particularly widespread or significant.

The unconsolidated aquifer material consists primarily of alluvium and is confined to Doyle Creek and its major tributaries. The alluvial material consists of moderately permeable silts, sands, and basal gravels overlying mostly shale bedrock.

The consolidated aquifer material in the watershed area consists of the Wellington Shale in the western two-thirds of the watershed and the limestone components of the Chase Group bedrock strata in the eastern one-third of the watershed. The depth to bedrock ranges from 0 to 50 feet. Generally, the depth to bedrock is greater in the western area of the watershed than the eastern.

The Wellington Formation is an approximately 500-foot thick deposit of mostly silty shale; however, layers of gypsum, thin limestones, and salt deposits are included in the subsurface. This formation generally yields small quantities of poor quality water.

The Chase Group strata consists of limestone layers ranging in thickness from 5 to 15 feet. These limestone layers are permeable as a result of water migrating through joints and bedding planes within the rocks and generally yield fair quantities of good quality water to wells in the areas.

CONFINED FEEDING AREAS

Confined livestock areas were inventoried to determine their potential as sources of NPS pollutants (fecal bacteria and/or organic matter).

The watershed supports approximately 52 confined livestock areas of 1 to 3 acres in size. Most are used during the winter and early spring months when range and pasture forage supplies are not adequate and feeding is required. Eighty percent of the confined feeding areas are utilized by beef cattle. The rest of the operations confine hogs, dairy cattle, or horses.

Confined livestock area conditions were inventoried and rated on the basis of: proximity to streams, foreign drainage, and the existence of pollution control practices. Fifty percent of them were in good condition with only a slight potential to impair water quality. Twenty-five percent of them were in fair condition with a medium potential to impair water quality.

The remaining 25 percent were in poor condition with a high potential to pollute water quality. Most of these areas had intermittent stream channels flowing through them part of the year, foreign drainage, with little or no signs of pollution control practices being used.

ARCHEOLOGY

The Kansas State Historical Society conducted a study of the watershed. Three national historic places were listed which include the Harvey House at Florence, the old Peabody Library, and Peabody Township Library, both located in Peabody. None of these properties will be affected by proposed dam construction.

There are no known archeological or historical resources at General Plan Dam Nos. 1, 3, 5, 9, 10 11, 12, 14, 101, 102, 103, 104, 106, and 107. Dam Nos. 2, 4, and 13 may affect buildings of unknown age. Dam Nos. 6, 7, and 105 are on or near the route of the historical trail known as the "California-Ft. Smith Road." Dam No. 8 appears to affect the "Old California Road." Dam No. 15 appears to be on or

near the "Pike's Peak-Cottonwood Valley Road." 8/ Each dam recommended for installation will be investigated to determine if construction will affect resources of historical value.

FISH AND WILDLIFE

The following species of fish were collected during the tri-agency aquatic field evaluation in July 1990: unidentified juvenile cyprinids, bluntnose minnow, central stoneroller, creek chub, fathead minnow, golden shiner, red shiner, redfin shiner, sand shiner, black redhorse, golden redhorse, river redhorse, spotted sucker, unidentified catfish larvae, black bullhead, yellow bullhead, various sunfish hybrids, bluegill, green sunfish, longear sunfish, orangespotted sunfish, mosquitofish, log perch, fantail darter, and orangethroat darter. Three other fish common to this stream but not collected during the survey are channel catfish, flathead catfish, and spotted bass. 9/

Wildlife species commonly found where suitable habitat is available are opossum, eastern cottontail, fox squirrel, beaver, muskrat, coyote, raccoon, skunk, white-tailed deer, bobwhite quail, meadowlark, cardinal, red-tailed hawk, northern flicker, ornate box turtle, red-sided garter snake, and western chorus frog. Federally listed endangered species which could occur include the least tern, bald eagle, peregrine falcon, Eskimo curlew, and whooping crane. The piping plover is considered threatened on the federal list. All federally listed threatened and endangered species are included on the Kansas State list. In addition to the species listed above, the eastern hognose snake, eastern spotted skunk, Kansas glossy snake, snowy plover, and white-faced ibis are included on the state list of threatened and endangered species. The Neosho madtom is found within the basin but not in the watershed. The Neosho madtom appears on both state and federal endangered species lists. Formal consultation has begun with the U. S. Fish and Wildlife Service on the effects this project, as well as others within the basin, may have on the Neosho madtom's habitat. 10/

Species candidates for federal listing that may occur include Clanton's cave amphipod, regal fritillary butterfly, Texas horned lizard, ferruginous hawk, snowy plover, long-billed curlew, and loggerhead shrike.

WATERSHED STREAMS

The watershed has an extensive stream system common to Kansas. There are approximately 200 miles of ephemeral, 80

miles of intermittent, and 60 miles of perennial stream in the watershed.

A 1981 stream evaluation study involving each Kansas perennial stream was conducted by the U.S. Fish and Wildlife Service, Kansas Department of Wildlife and Parks, and Kansas State University, Division of Biology. Ratings were based on a set of six criteria. These were:

General Characteristics	Value Class II Rating	Emphasis
1. Fishery characteristics	Good fishery	Fish species diversity and types of game fish
2. Angling use value class	High use area	Types and amounts of utilization plus special runs of fish
3. Water quality value class	Good water quality	Concentrations of suspended sediments, pollution, extremes in chemical variables
4. Stream uniqueness	Relatively attractive area	Quality of surrounding setting coupled with amount of disturbance
5. Riparian association value class	Relatively diverse vegetation	Diversity and abundance of vegetation and associated terrestrial wildlife
6. Habitat restoration, reclamation, or mitigation potential	Highly sensitive area	Sensitivity of the area to disturbance and ability to replace lost or altered resources

Utilizing the above stream characteristics, a rating system was developed by the Kansas Department of Wildlife and Parks. This system uses four value classes: (1) Highest-Valued Fishery Resource, (2) High-Priority Fishery Resource, (3) Moderate Fishery Resource, and (4) Limited Fishery Resource. Doyle Creek was given a stream fishery value of (2) High-Priority Fishery Resource. Spring Creek, a Doyle Creek tributary, was given a value of (3) Moderate Fishery Resource. Currently only a 17-mile segment of Doyle Creek provides angler days of fishing. The potential exists, particularly with Newton and Wichita near by, to develop the stream fishery and enhance the opportunities for use.

FORESTLAND

The watershed has about 2,750 acres of woodland which are all in private ownership. Approximately 970 acres are on the flood Plain and 1,780 acres are scattered throughout the upland area. 4/

The bottomland timber types are about evenly divided between the elm-ash-cottonwood type and the lowland plains hardwood type in which the major components are hackberry, bur oak, and walnut. Other species commonly found in

bottomland include boxelder, Kentucky coffeetree, black willow, osageorange, and honeylocust.

In the upland forests, the major types found are the oak-hickory type and the elm-ash-locust type. Bur oak and chinkapin oak are the predominant oaks. Osageorange, honeylocust, and eastern redcedar are frequent invaders into upland range and pasture areas.

Of the total woodland acreage, an estimated 250 acres are classified as noncommercial forest--mostly due to dry, rocky, and shallow soils.

In addition to the natural woodlands, there are an estimated 260 acres of windbreaks (160 miles) within the watershed. There also are an estimated 650 acres of wooded pasture and range.

Some of the commercial forest areas contain marketable quantities of such timber species as ash, black walnut, bur oak, cottonwood, hackberry, and other species of mixed hardwoods. Many of the watershed's woodland areas are on good sites and are well stocked with trees, but contain large proportions of low value species (elm, honeylocust, boxelder, etc.) and cull trees due to lack of management.

Farmers tend to perceive forestry activities as something that will benefit others, but not themselves. An educational effort needs to be directed at creating understanding of the multiple benefits derived from good forest management activities including future income opportunities that are coupled with the management costs of forestry in order to encourage farmer inputs. Because many of the benefits of good forestry practices are long term and considered societal in nature, the full range of incentives for landowners who apply them should be explored as part of any educational effort.

Trees growing in wooded pastures are generally on poorer sites, frequently even-aged, without reproduction, and disappear as the existing stands die. In other situations, wooded pasture occurs as a "go-back" vegetation which is becoming stocked by invading tree species and will gradually convert to forest if current management is continued. Timber values in these wooded pastures are not projected to be of great significance; however, these areas can provide unique and valuable wildlife habitat and some hydrologic benefits to the watershed. They can be a source of posts and firewood.

FORECASTED CONDITIONS

Future conditions without the project are projected for a 10-year period. About 75 percent of the highly erodible

cropland will be treated by 1995. No major changes in resource conditions are predicted beyond the next 10 years that would impact project formulation.

Land Use - Future land use without the project accounts for some projected changes that are expected within the next 10 years. By comparing Table H with present conditions, Table G, you can see the projected changes.

Table H - Future Land Use Without Project

Land Use	Evaluated Flood Plain		Upland		Total	
	Acres	%	Acres	%	Acres	%
Cropland	4,220	74.2	35,860	42.8	40,080	44.8
Grassland	210	3.6	40,400	48.3	40,610	45.4
Forestland	970	17.1	1,760	2.1	2,730	3.1
Other Land	30	0.5	3,940	4.6	3,970	4.4
Stream Channel	170	2.9	--	--	170	0.2
Water Area	--	--	1,250	1.5	1,250	1.4
Urban	100	1.7	500	0.7	600	0.7
TOTAL	5,700	100.0	83,710	100.0	89,410	100.0

Land use projections show a reduction in cropland and an increase in grassland. More farm ponds are projected, as well as construction of two state-funded dams. This will result in an increase in water surface acres.

Food Security Act - As required by the 1985 Farm Bill, all of the cropland has been evaluated for potential erosion. The highly erodible cropland amounts to 11,350 acres. SCS has helped farmers prepare conservation plans on about 95 percent of this land. It is expected that by 1995, 75 percent of the highly erodible cropland will have land treatment practices applied.

Conservation Reserve Program - There have been 3,800 acres of cropland converted to grassland under the CRP program. About 3,450 acres will remain in grassland after the 10-year contract. The balance will come out of CRP. When this happens, land treatment practices to control erosion will be needed.

Going Program - Farmers will install a limited number of enduring practices in the future due to limited funds. Conservation tillage will be the primary conservation practice. No-till will be adopted by a few farmers.

Flood Damages - Crop and pasture, other agricultural property, road and bridge, railroad, and flood Plain scour damages are expected to increase in the future without the project.

Total flood Plain acres are not expected to change without some type of group project. Conservation treatment by the going program and 1985 Food Security Act will treat about 7,800 acres and reduce flood peaks about 2 percent.

Crop Yields - Potential crop yields have increased dramatically over the last 50 years due to changes in technology. The flood-free yields reflect application of known technology. Present yields were used for all erosion evaluations, such as sheet and rill, ephemeral, and depreciated.

Erosion - Land quality will continue to decline because of erosion rates exceeding the tolerable soil loss. Exposure of subsoils, particularly claypans, will severely restrict root zones, water holding capacities, and availability of plant nutrients. Infiltration rates will decrease thereby reducing available water and nutrients for potential crop yields. Table I lists erosion, types, and quantifies watershed totals for each category. Table J shows the amount of sediment discharged from the watershed by types.

Table I - Erosion by Source
(tons per year)

Type	Present	Future Without
Sheet and Rill	194,200	154,090
Ephemeral Gully	69,900	36,900
Gully	5,300	5,200
Stream Bank	32,700	29,660
Flood Plain Scour	9,900	9,750
Total	312,000	235,600

Table J - Sediment Yield by Source
(tons per year)

Type	Present	Future Without
Sheet and Rill	41,800	35,900
Ephemeral Gully	46,800	24,700
Gully	4,300	4,500
Stream Bank	29,600	28,100
Flood Plain Scour	9,000	9,000
Total	131,500	102,200

Ephemeral Gully Erosion - Ephemeral gullies will continue to erode untreated cropland fields. These are generally natural water courses which collect, concentrate, and convey surplus water off upland fields. Time of year, storm intensity, soil type, management practices, and slope affect width and depth of soil being eroded.

Classic Gully Erosion - Gully erosion is not significant. A few raw stream banks can be seen in the watershed. These gullies will continue to erode and yield some sediment.

Streambank Erosion - Most stream banks are stable and will continue to be stable eroding at a slow rate. Approximately 10 percent of the present watershed erosion comes from streambank erosion. This percent is projected to be nearly 13 percent in the future without the project.

Streambank erosion is much more significant when measured by sediment yield. This source contributes over 22 percent of sediment yield now and is projected to contribute almost 28 percent of total sediment yield in the future. See Tables I and J for greater details.

Sediment Deposition - Sixty-seven percent of the sediment originating in this watershed will be deposited in John Redmond Reservoir. Sediment will continue to be deposited in road ditches, ponds, on roads, and flood plains. The following table shows projected sediment deposition by location:

Table K - Projected Future Sediment Deposition

Category	Per Year	
	Tons	Acre Feet
Doyle Creek and Tributaries[a/]	1,000	1
Ponds	7,400	5
Cottonwood River	1,800	2
Road Ditches	27,900	15
John Redmond Reservoir	93,100	68
Flood Control Structures	6,500	4
Total	137,700	95

a/ Sediment is flushed through the system

Sediment transported nutrients, as well as those nutrients in solution, will continue to foster algae blooms. Stream uses will continue to be impaired.

Water Quality - Under "future without" conditions, water quality for surface and ground water will still be impaired.

Sediment and phosphorus delivery to the streams will be reduced. Remaining concentrations will still exceed the state criteria for water quality. Levels of fecal bacteria and organic matter are expected to remain constant or decrease slightly. Surface water use for aquatic life and contact and non-contact recreation will still be impaired.

No change is forecast in the condition of the ground water.

Nitrate is the primary ground water pollution concern. Livestock death losses may occur because of high nitrate rates. Seepage into farm wells because of well site location, construction, or maintenance may be the source of increased nitrates at some locations.

Most of Doyle Creek's future water quality problems will be from non-point pollution sources. Such sources are excessive soil erosion, runoff and leaching from livestock feeding operations, improper or inadequate private wastewater disposal, and improper fertilizer and pesticide use. Improper well construction, location, and abandonment are expected to continue to be problems.

Erosion on untreated cropland will continue to affect surface water. Lands near stream channels with high sediment delivery factors may still deliver unacceptable concentrations of suspended solids to surface waters. Improper management and disposal of livestock and human waste may continue to pollute surface and ground water. Nitrate leaching may continue to be a problem. These conditions will continue in the future without project action.

More farmers and ranchers will get their water from rural water districts in the future. Public awareness will encourage plugging of abandoned wells as well as improved sealing of existing wells.

Stream Ecosystems - In general the fishery habitat and the quality of stream ecosystems are expected to continue in their present degraded condition. The projected use of fertilizers and pesticides and the presence of excessive soil erosion are expected to continue which will restrict the water quality as a fishery. The entire food chain will be disrupted and game fish (primarily predators) are the primary species affected. Toxic substances may also prove to be limiting factors to the aquatic producers and/or consumers.

Wildlife - Present habitat units and projected habitat units are shown in the following table:

Table L - Projected Habitat Unit[a/] Changes Without a Project

Land Cover	Average Value	Present Habitat Units	Projected Habitat[b/] Units	Change in Habitat Units	Percent Increase/ Decrease
Cropland	2.5	106,400	100,200	- 6,200	- 5.9
Grassland	3.0	114,300	121,700	+ 7,400	+ 6.5
Woodland c/	5.7	15,600	15,500	- 100	- 0.8

a/ Habitat units equal the rated quality value (varying from 1 to 10) multiplied by acres
b/ Assuming the quality factor (average value) remains constant
c/ Includes riparian and upland woodland

Confined Feeding Operations - The water quality emphasis today will bring pressure to bear on farmers who have feedlots located on or near streams to relocate them so that discharges are filtered or prevented from reaching streams. Through a public information program farmers will be informed of the water quality problems and possible corrective measures.

A few livestock producers will implement management and structural practices to correct minor feed lot problems without a project. Costly improvements will likely be left for project cost-sharing funds to solve.

Forestland - Over-mature stands will likely be the condition in the future. Failure to harvest in a timely fashion will result in gradual decline of stand vigor with resulting loss of water quality, wildlife, and potential landowners' income.

Selected timber areas are projected to be over exploited in the future which will restrict the areas' capability of improving water quality, eliminate some wildlife habitat, and create a risk that the areas may be converted to other land uses because of their low economic value. Young stands where management is neglected will have the same effect.

Some riparian forested areas on tributaries and upper reaches are expected to be over grazed. This condition will permit continued stream bank erosion, lower water quality, and limit wildlife habitat.

Tree planting activity is not expected to significantly increase in the future. The high initial investment required for tree planting and the long-term production cycle required for tree growth is not a normal crop production concept. This attitude will likely continue in the future unless planting costs are reduced or other beneficial values become important to farmers.

Many miles of osage-orange hedgerows will continue to be over mature. Too frequently, these hedgerows are destroyed and their potential for wind protection, erosion control, wildlife habitat, and crop protection is lost.

Uncontrolled wildfires cause significant damage to the soil and water resources by damaging or destroying the native grass and forest vegetation. This can accelerate runoff and soil erosion and reduce economic productivity and wildlife habitat. While the 2,750 acres of forest and 38,090 acres of grassland will continue to be subject to wildfires, even cropland such as wheat fields can be subject to destructive fires.

FORMULATION OF ALTERNATIVES

FORMULATION PROCESS

The Principles and Guidelines for Water and Related Land Resource Implementation Studies describe study objectives and outline study procedures to formulate a National Economic Development (NED) plan. This plan is to increase the value of the nation's output of economic goods and services or to improve economic efficiency. This is to be done in a way to protect the nation's environment either by conserving or preserving the non-monetary aspects of man's surroundings, such as cultural resources, ecological systems, or natural resource qualities. Other plans may be formulated which would meet local sponsor objectives. Plans other than the NED plan would require a Secretarial exception for implementation.

The Doyle Creek Watershed District was organized according to Kansas State statutes for the purpose of watershed protection and flood prevention. Each year part of the state's general tax funds is allotted for design and construction of state-funded dams and associated land treatment. Kansas law requires that a general plan be prepared by the watershed district before state funds will be made available.

The 1975 General Plan describes the watershed conditions and quantifies watershed problems, solutions, and beneficial effects that would stem from project action. The Doyle Creek Board determined that their main problem was flood damage; therefore, the General Plan is limited to a discussion of flood damages, potential dams, dam characteristics, and dam costs to reduce flood damages as much as possible.

Since 1975 the Clean Water Act was passed by Congress and more and more concern is being directed towards cleaning up all of our nation's water. Kansas has adopted state water quality standards.

Water quality was not a primary goal of the watershed board, but the board was willing to include water quality studies during the watershed investigation and analysis. The board provided funds, personal contacts, and collected limited water quality data in the process. They reserved the right during investigation and analysis to determine later whether they would include features of the water quality plan in the Recommended Plan.

Consideration was given to a non-structural plan consisting of reducing the number of roads and bridges crossing the flood plain, relocating the main roads above the 100-year flood plain, and planting cropland flooded more frequently

Table M - Measures to Satisfy Problems and Opportunities

Problems and Opportunities	Floodwater Retarding Dams	Land Treatment on Cropland and Forest Land	Improve Confined Livestock Feeding Operations
To increase agricultural income:			
Reduce soil loss on 49,000 acres greater than "T"	N	+	N
Maintain erosion control practices on 27,200 acres	N	+	N
Reduce flooding on 5,700 acres	+	+	N
Reduce other agricultural damages on 40 farms	+	+	N
To protect public and private properties:			
Reduce road and bridge flood damages	+	+	N
Reduce urban flooding at Peabody	+	+	N
To improve water quality:			
Reduce sediment load	+	+	+
Reduce sediment deposition at John Redmond Reservoir	+	+	+
Reduce livestock waste in streams	N	N	+
Improve waste water discharge from Florence and Peabody	N	N	N
Reduce nutrient and pesticide losses to surface and ground water resources	N	+	+
Protect farm wells from surface contamination	N	N	+
To enhance environmental values:			
Improve stream aquatic habitat	+	+	+
Improve wildlife habitat	N	+	+
Increase habitat diversity	+	+	N
Protect woody riparian habitat	+	+	N
Reduce sediment yield	+	+	+
Reduce scour on 600 acres of flood plain	+	+	+
Reduce erosion in forest land	+	+	N
Reduce soil loss on 49,000 acres	+	+	N
Maintain erosion control practices on 27,200 acres	N	+	N

(+) favorable impact (N) no impact or negligible impact (-) adverse impact

than once each year to grassland. This alternative was not acceptable to farmers and ranchers; therefore, it was dropped from further consideration.

Two plans were formulated for this watershed, the NED plan and a water quality plan. The NED plan was formulated by using an incremental analysis procedure. The water quality plan was formulated to be the most cost-effective means of meeting the state's water quality standards. It included the NED plan dams plus other dams and land treatment to meet the state's water quality standards.

See Table M for a list of measures to satisfy problems and opportunities.

NED Plan Formulation - The NED formulation focused on flood control only. Each dam selected has benefits greater than costs.

About 16 years ago, the Doyle Creek Board hired a consultant to locate all of the potential dam sites in the watershed that could be built for flood control. The results of this work were summarized and released in a General Plan in 1975 according to Kansas state laws.

The NED formulation began by updating costs of all the General Plan dams and distributing flood damage reduction benefits to each dam based on a first increment routing. A comparison of benefits and costs for each dam was then made. This comparison of benefits and costs was presented to the watershed board for them to select which dams they wanted evaluated in greater detail. The board requested SCS to consider Dam Nos. 16, 17, and 18 besides the list of General Plan dams. Comparisons of benefits and costs for the General Plan dams and Dam Nos. 16, 17, and 18 were presented to the board.

Several computer runs were made to determine the NED plan. A greater explanation of the reasons to select certain alternatives and a list of alternatives modeled appear in Appendix C, Investigation and Analysis Report, Hydrology.

A core system of Dam Nos. 6, 10, 11, 101, and 102 was identified through this evaluation process. Dam No. 5 was tested to determine if its benefits exceeded costs. Dam No. 5 benefits exceeded costs and was added to the system. Dam No. 4 was added next. Dam No. 4 did not have benefits greater than costs; therefore, the NED plan is limited to Dam Nos. 5, 6, 10, 11, 101, and 102.

Table N - Incremental Analysis of Structural Measures

Alternatives	Total Costs $	Incremental Costs $	Total Benefits $	Incremental Benefits $	Net Benefits $
5 Dams	170,400	--	209,700	--	39,300
6 Dams	206,700	36,300	261,700	52,000	55,000
7 Dams	225,900	19,200	273,200	11,500	47,300

Water Quality Plan Formulation - The Kansas Department of Health and Environment (KDHE) has determined the various water quality contaminants and the maximum level of concentration that is acceptable to meet their standards. The following table shows water quality criteria and the status of Doyle Creek's water:

Table O - Kansas Water Quality Standards Compared to Doyle Creek's Water Samples

Contaminant	Quality Criteria	Doyle Creek
Nitrate - N (mg/l)	1.2	1.38
Phosphorus (mg/l)	0.1	0.24
Suspended Solids (mg/l)	100	240
Fecal Coliform (#/100 ml)	200/2,000[a/]	9,800
BOD_5	3.0	4.3
Atrazine (ug/l)	3.0	1.6
Alachlor (ug/l)	0.5	0.18

a/ Low flow and high flow concentration levels

KDHE described the level of treatment necessary to meet the state's standards. The following is a list of goals and actions that were used to formulate the water quality plan:

Reduce suspended solids delivered to Doyle Creek by 60 percent
Reduce total phosphorus by 60 percent
Reduce organic waste loading by 30 percent
Reduce fecal bacteria reaching Doyle Creek by the greatest amount feasible; hopefully, to achieve a 95 percent reduction.
Implement pesticide management practices to reduce losses in runoff and leaching
Implement nutrient management practices to protect ground water from nitrate leaching
Implement livestock and human waste management/disposal practices to protect ground water from nitrate leaching

Nitrate is not directly associated with sediment and moves in solution in surface water. Major sources of nitrogen

in the Doyle Creek Watershed include organic nitrogen and ammonia, which may convert to nitrate upon oxidation, as well as nitrate from fertilizer and animal waste. Project formulation, using the effects of alternative treatment practices to reduce nitrate loading, were estimated on a basis of one half of the reduction of sediment, to reflect reductions in partially attached nitrogen sources such as ammonia or organic sources. There are also effects that would be associated with nutrient management practices. Reduction in nitrogen sources from animal waste practices may be estimated to be proportional to the reduction in loading of animal waste from discrete sources.

Plan formulation began by identifying sources of pollutants, in particular, sediment. Sediment because of its ease in routing served as a surrogate for other pollutants.

The watershed was divided into six subwatersheds and potential sediment yield zones. These zones differ in potential for pollutant yields. In general, the highest potential yield zones are those closest to stream channels. Slope has a significant effect too. The potential yield factors are a combination of distance, topography (slope), land use, and erosion rates.

Formulating with a large number of small ponds was not analyzed due to limiting physical locations and social acceptability. Flood control dams that were feasible were included first along with a level of land treatment that was viewed as a realistic attainable goal. Flood control structures were chosen for their pollutant trapping efficiency. Land treatment practices were chosen for two reasons: resource protection and pollutant reduction potential.

The pollutant reduction of this system was compared to the reduction goals to see if the state water quality standards were met. The first scenario analyzed was an 85 percent land treatment rate with 9 dams and 75 percent land treatment above the dams. This alternative did not provide the needed overall pollutant reductions. A second alternative included 85 percent land treatment and 13 dams. This alternative effectively controlled sediment, nutrients, and organic matter to meet state standards.

Further reduction was needed for fecal bacteria and phosphorus. This was achieved by additional management practices and treating the livestock confined feeding areas. The Water Quality Plan includes 85 percent land treatment, 13 dams, and treating the confined feeding areas. This plan meets the water quality standards. The water quality alternative includes Dam Nos. 3, 4, 5, 6, 9, 10, 11, 12, 16, 17, 18, 101, and 102. These dams control 34,200 acres or 38.3 percent of the watershed.

In addition, 5,730 acres of untreated cropland would be treated. Gradient terraces and contour farming would be installed on 3,600 acres, conservation tillage systems on 2,130 acres which includes strip cropping and no-till farming.

EVALUATION OF ALTERNATIVES

Alternatives considered during planning are described in this section. Costs and economic, environmental, and social impacts of greatest significance to decision making are compared in Table P. The watershed map in Appendix D shows the dams included in the NED plan in solid color and the other water quality dams by cross hatch.

Alternative 1 (No project) consists of continuing the present conservation program without project action for the next 10 years. The going conservation program and compliance to the Food Security Act will treat 7,200 acres of cropland during the 10-year period. Some HEL cropland acres will remain untreated. Another state-funded dam is planned for construction. Excessive erosion and flooding will continue.

Alternative 2 is the National Economic Development (NED) plan. This plan includes the going program and the accelerated Food Security Act Program as well as six flood control dams and forestry land treatment on 1,560 acres.

Forestland resource plan measures include improvement on 960 acres and fire control measures on 40,840 acres which include 38,090 acres of grassland. The forestland improvement consists of prescribed timber harvesting and tree planting. Fire control measures are improved fire control equipment and training of volunteer rural firemen. Tree plantings will be for riparian buffer strips. The forestland will be treated and managed primarily for long-term streambank stabilization, water quality, and incidental benefits to wildlife habitat, timber, and wood products.

Costs: Total project costs - $2,577,900; P.L. 83-566 share - $2,087,900; other $490,000; average annual cost - $233,200; operation, maintenance, and replacement cost - $7,600.

Effects: This alternative would reduce scour by 950 tons on 600 acres of the Doyle Creek flood plain and would reduce the sediment yield from Doyle Creek Watershed to the Cottonwood River by 23,100 tons or by 23 percent. Annual flood damages in the watershed would be reduced by about 31 percent or $73,000 and flood damages along the Cottonwood River would be reduced by 3.7 percent or $159,500.

The forestland treatment plan will provide viable riparian buffer strips along 12.5 miles of streams that will improve stream fishery, improve water quality, reduce streambank erosion, and other benefits with a total estimated value of $34,900 annually.

The average annual benefits of this alternative are estimated to be $296,600 and the estimated annual costs are $233,200. The net annual benefit therefore is estimated to be $63,400.

The NED Plan will reduce sediment by 52 percent, phosphorus by 43 percent, nitrates by 20 percent, organic matter by 34 percent, and have no effect on fecal bacteria. It does not meet the water quality goals.

Alternative 3 is the Water Quality Plan. This alternative uses a system of dams and land treatment measures to meet the state's water quality standards. The NED dams (No. 5, 6, 10, 11, 101, and 102) are included as well as Dams No. 3, 4, 9, 12, 16, 17, and 18. About 3,600 acres will be terraced and 2,130 acres will be conservation tilled. An estimated 52 livestock feeding operations will be treated.

Costs: Total project costs - $4,939,800; P.L. 83-566 share - $4,006,200; other $933,600; average annual cost - $463,500; operation, maintenance, and replacement cost - $31,200.

Effects: This alternative would reduce scour by 1,250 tons on 600 acres of the Doyle Creek flood plain and would reduce the sediment yield from Doyle Creek Watershed to the Cottonwood River by 51,300 tons or by 51 percent. Total erosion would be reduced by 42,200 tons--from gully erosion by 1,200 tons, ephemeral erosion by 17,300 tons on 5,733 acres, sediment and rill erosion by 18,100 tons, streambank erosion by 4,400 tons, and flood plain scour by 1,200 tons. Phosphorus will be reduced by about 20 tons. Approximately 3,600 acres of untreated cropland will be terraced. Much of the sediment from untreated cropland will be trapped by the 13 dams. The 100-year flood plain would be reduced by about 600 acres. Annual flood damages in the watershed would be reduced by 41.7 percent or $98,500 and flood damages along the Cottonwood River would be reduced by 5.7 percent or $243,800.

The forestland treatment plan will provide viable riparian buffer strips along 12.5 miles of streams that will improve stream fishery, improve water quality, reduce streambank erosion, and other benefits with a total estimated value of $34,900 annually.

Table P - Summary and Comparison of Candidate Plans

Effects	Future Without Project	Alternative 2 NED Plan (Recommended Plan)	Alternative 3 Water Quality-Plan
Measures	Continue on-going land treatment program including CRP and 1985 Food Security Act	Continue on-going program, 6 floodwater retarding dams, and 1,560 acres of forestland treatment	Continue on-going program, 13 floodwater retarding dams, and 1,560 acres of forestland treatment
Problem Areas Treated	0	6	13
Project Investment	0	2,577,900	4,939,800
National Economic Development Account			
Adverse, Annual	-	233,200	463,500
Beneficial, Annual	-	296,600	492,200
Net Beneficial	-	63,400	28,700
Environmental Quality Account			
Beneficial			
Going Program Effects	Treat 650 acres of cropland	Treat 650 acres of cropland	Treat 650 acres of cropland
Tons Sheet and Rill Erosion			
All Cropland	120,300	120,300	103,800
Untreated Cropland	59,000	59,000	32,100
Ephemeral Gully Area			
Affected Acres	807	807	400
Voided Acres	94	94	47
100-Year Flood Plain Will Be Reduced - Acres	0	250	500
Scour Acres	606	464	400
Tons Sediment Yield	102,200	79,100	50,900
Percent Sediment Yield Reduction	0	23	50
Cropland Treated	0	0	5,733
Livestock Feeding Areas Treated	0	0	52
Beneficial to Wildlife and Aquatic Life			
Convert Cropland to Water	0	97	243
Convert Grassland to Water	0	157	215
Convert Forestland to Water	0	16	34

Table P - Summary and Comparison of Candidate Plans, Continued

Effects	Future Without Project	Alternative 2 NED Plan (Recommended Plan)	Alternative 3 Water Quality Plan
EQ Account, cont'd.			
Percent Pollutant Reduction			
Sediment	23	52	60
Phosphorus	21	43	47
Nitrates	9	20	22
Organic Matter	17	34	36
Fecal Bacteria	0	negligible	80
Tons Stream Bank Erosion	29,700	26,700	25,300
State Water Quality Standards	will not meet	will not meet	meets standards
Adverse to income			
Convert Cropland to Water	0	97	243
Convert Grassland to Water	0	157	215
Convert Forestland to Water	0	16	34
Other Social Effects			
Beneficial			
Going Program Cropland Treated	650	650	650
Project Action			
Cropland Treated	0	0	5,730
Forestland Treated	0	1,560	1,560
HEL Cropland Treated by 1995	9,600	9,600	9,600
Regional Economic Development			
Positive Effect			
Annual	a/	296,600	492,200
Region	a/	296,600	492,200
Rest of Nation	a/	0	0
Negative Effect			
Annual	a/	233,200	463,500
Region	a/	50,500	112,900
Rest of Nation	a/	182,700	350,600

a/ Not measured

The average annual benefits of this alternative are estimated to be $492,200 and the estimated annual costs are $463,500. The net annual benefit therefore is estimated to be $28,700.

The Water Quality Plan will reduce sediment by 60 percent, phosphorus by 47 percent, nitrates by 22 percent, organic matter by 36 percent, and fecal bacteria by 80 percent. It will meet the water quality goals. See the Preliminary Water Quality Assessment Report by Vic Robbins of KDHE. 3/

COMPARISON OF CANDIDATE PLANS

The National Economic Development Plan was selected by sponsors after consideration of their financial resources, preferences expressed by the public, and their assessment of the social impact of land rights acquisition.

Because Alternative 1 would have virtually no impact on any of the planning objectives nor on any key environmental issues, the sponsors did not consider no-project action as an acceptable alternative.

The NED Plan, Alternative 2, includes 6 floodwater retarding dams. It costs $2,361,900 less than the Water Quality Plan. The going program would continue. This alternative is considered the most efficient flood control plan.

The Water Quality Plan, Alternative 3, includes 13 floodwater retarding dams, land treatment on 5,733 acres of cropland, treating 52 livestock feeding operations, and treating 1,560 acres of forestland. Flood damage would be reduced 42 percent. The state water quality standards would be met by this alternative.

The Water Quality Plan would protect and enhance the watershed streams. This plan does a more complete job of meeting all project objectives. Erosion would continue but at a much slower rate than without the plan. This alternative would cost $2,361,900 more than the NED Plan.

PROJECT INTERACTION

The Doyle Creek Watershed District, farmers, and the State of Kansas have cooperated in installing four floodwater control dams. These are Dam Nos. 7, 8, 104, and 105. They were included as future without project and complement this project.

Certain elements of the formulated water quality plan will be implemented using state cost-share programs. These programs complement the P.L. 566 NED plan to accomplish a complete water quality plan.

Marion County Conservation District in cooperation with Harvey County Conservation District has developed a Non-point Source Management Plan for this watershed. This management plan is a comprehensive plan guiding all programs which will utilize state and federal resources to solve the NPS pollution problems. The plan calls for annual reviews and amendments as needed.

RISK AND UNCERTAINTY

Benefits expected to accrue to the planned measures depend upon the installation of the complete plan. Dropping any one dam will change the volume of flood water in Doyle Creek. This situation could significantly alter flood damage reduction benefits.

The board selected the National Economic Development plan. Based on attitudes of landowners during site survey and preliminary evaluations, the watershed district board believes that there is strong local acceptance of the system of dams in the NED alternative. It appears likely that all six dams will be constructed.

There is uncertainty about the water quality plan. Reasonable land rights for Dam Nos. 3 and 12 are not available now. If constructed, both dams will likely require full land rights purchase. Costs for Dam Nos. 16, 17, and 18 were made without benefit of detailed topographic maps. Detailed surveys may show them to be undesirable.

Treatment of the 52 livestock feeding areas is tentative. About 13 livestock feeding areas need to be relocated away from streams. Most of the landowners have yet to be contacted and asked to participate; therefore, it is uncertain whether all of these units will be treated.

The plan analysis assumed no dramatic changes in technology, crop prices, government programs, or agriculture in general. As a result of the 1985 Food Security Act (FSA), landowners may plant untreated, highly erodible cropland (HEL) to non-commodity crops or convert these acres to non-cropland uses to avoid non-compliance. It is projected that 75 percent of the HEL cropland will be adequately protected by 1995. The rate of application may be increased if federal and state cost-share funds were increased before the 1995 FSA deadline.

RATIONALE FOR PLAN SELECTION

The district board selected the NED plan for PL-566 implementation. The board wants to build other dams to realize more flood damage reduction benefits. They plan to do this through a state funded cost-share program.

Land treatment of cropland beyond the projected 1985 Food Security Act application was not made a part of this project. The Harvey and Marion County conservation districts have agreed to sponsor the land treatment portion of the Water Quality Plan.

Land treatment is not a part of this plan except for forestry land treatment. Most of the highly erodible land (HEL) will be treated over the next ten years which limits the number of acres of cropland that needs treatment.

The water quality plan was not selected by sponsors even though more flood control would be achieved. This watershed district board backed away from this plan because of the cost-sharing percentages involved and also the concern over social acceptability of the plan at this time.

RECOMMENDED PLAN

PURPOSE AND SUMMARY

The project is planned for the purposes of flood prevention and water quality. The recommended plan is the NED plan and includes six floodwater retarding dams and forestland treatment. For additional details about the Recommended Plan (NED), see Tables 1, 2, 3, and 6 and the Project Map (Appendix D).

Terraces and other land treatment practices planned as part of the Water Quality Plan are not part of this plan. The woodland land treatment program is a part of this plan.

PLAN ELEMENTS

Forestland Treatment - A Forest/Woodland Resource Plan 4/ was developed for Doyle Creek Watershed by Kansas State and Extension Forestry, cooperating with the USDA Forest Service. Forestry technical assistance will be provided through the watershed project and the Cooperative Forest Management Program. Forestland improvement includes enduring practices of timber stand improvement, tree planting, and filter strips which will permit an increased annual harvest of high quality trees, reduce streambank erosion, and reduce phosphorus and nitrates.

The watershed is protected by rural fire districts. Equipment procurement, training in fire fighting and control, and fire prevention education will be continued. Technical assistance for fire control measures will be provided by Kansas State and Extension Forestry through the Cooperative Fire Control Program.

Structural Measures - Six floodwater retarding dams will be installed as structural measures to reduce flooding and enhance water quality. All structural measures will be earth dams. See Project Map (Appendix D) for structure locations.

Each floodwater retarding dam will have a drop-inlet type principal spillway constructed to maintain water at a specific elevation to trap sediment and to release floodwater from a detention pool. (A typical dam with a drop-inlet principal spillway is shown in Appendix B.)

Principal spillways will be of reinforced concrete and each will have a single-stage uncontrolled inlet. Release rates will average about 20 cubic feet per second per square mile (csm) and will not exceed present downstream channel capacities.

The dams will have vegetated or rock emergency spillways to discharge runoff safely when reservoir and principal spillway capacities are exceeded. In any one year the chance of operation of the emergency spillway at any site is 4 percent or less. Emergency spillways of some structures will require topsoiling to establish and maintain vegetation.

The six dams will provide detention storage varying from 3.30 to 4.61 inches of runoff from their respective drainage areas. Runoff from 34.63 square miles, 25 percent of the watershed, will be controlled. The combined volume of floodwater storage will be 7,329 acre-feet (equivalent to 4.0 inches of runoff from the drainage area controlled) with a combined temporary surface area of 884 acres.

Principal spillway crests are designed to maintain water at the elevation for storage of the 100-year accumulation of sediment. Sediment storage capacities vary from 0.51 to 1.60 inches. Combined sediment storage volume for all structures will total 1,601 acre-feet. Combined surface area of the sediment pools will total 270 acres.

Borrow areas will be confined to sediment pools and emergency spillway excavations, where practical. Borrow areas will be left rough and uneven to enhance fish production, where practical. Borrow material at most dam sites will be CL and CH (Unified Soil Classification System).

Existing trees and brush will be left in pool areas for fishery enhancement where it is requested by sponsors and will not interfere with structure operations. Maintenance costs may increase slightly by leaving trees and brush in sediment pool areas.

Most of the floodwater retarding dams may be on bedrock and/or alluvial foundations. Depth of soils in most abutments will be shallow.

The need for water and air pollution abatement during construction will be determined on a site-by-site basis. Abatement measures normally include dry stream crossings, temporary vegetative establishment, watering for dust control, and temporary sediment control basins.

EFFECTS ON EXISTING PHYSICAL FEATURES

These dams are located so as not to conflict with existing physical features. The maximum flood detention pool for Dam No. 5 will back water under a county road during the 100-year storm. Water will go through the road culvert but not overtop the road surface.

MITIGATION FEATURES

Construction of floodwater control dams requires land area for the dam and spillway, sediment pool, and detention pool. The mitigation process requires the identification of wildlife habitat now and in the future before construction starts. The theory is to mitigate the crucial habitat. The Kansas Department of Wildlife and Parks has agreed that woodland habitat is the crucial habitat; therefore, it is to be mitigated.

The technique is to have a team of biologists visit each dam site and rate cropland, grassland, woodland, and miscellaneous land habitat on a scale of 1 to 10. The next step is to multiply acres of each land use category times the rated value to determine the total number of habitat units to be lost.

It was agreed to mitigate for 100 percent of the woodland habitat to be lost and partial mitigation of the herbaceous. The steps are listed below:

1. All dams will be fenced and seeded.
2. In cropland, the seeding will be a native grass and forb mixture.
3. In pasture or range land, the seeding will be the same species as the area around the dam.

The system of floodwater retarding dams without mitigation would result in a loss of 256 habitat units of woodland and 1,172 habitat units of herbaceous habitat. Table I, Appendix C, shows the acreages of land, by dam and by land treatment type, that sponsors will provide for compensation of wildlife habitat losses. Compensation measures will be located in the general vicinity of the floodwater retarding dams; however, actual location will be determined during land rights acquisition. Landowners who desire wildlife areas will be given first consideration. Wildlife habitat compensation measures include establishment and management of native grasses and forbs on 65 acres, woody plantings on 31.9 acres, or woodlands preservation and management on 60.9 acres (using an average value of 4.2 habitat units per acre). A combination of woody planting and preservation may be used.

Mitigation features will be installed at the same cost-share rate as the floodwater retarding dams.

PERMITS AND COMPLIANCE

Construction permits from the State Board of Agriculture, Division of Water Resources, are required for these

project dams. It is not anticipated that 404 Permits will be required (Section 404 of P.L. 92-500); but if at the time of construction 404 Permits are required, the watershed district will obtain these permits.

SCS cultural resource procedures will be completed during installation for practices that may affect such resources. SCS will consult with the State Historic Preservation Officer to develop means to mitigate or eliminate adverse effects that may occur to significant cultural resources.

Kansas Department of Wildlife and Parks requires permits where there are critical habitats for threatened and endangered species. At this time there are not any such species involved; but if any exist at construction time, the watershed district is responsible for all required permits.

DAM SAFETY

In the event of failure, damage to the area downstream of a class "a" dam would be limited to farm buildings, agricultural land, or township and county roads. A greater hazard potential could be created if additional development occurs in the breach inundation area of the dam. The hazard classification would then become either class "b" or class "c." For class "b" dams, damage would be limited to isolated homes, main highways, minor railroads, or interruption of service of relatively important public utilities. For class "c" dams, loss of life or serious damage to homes, industrial and commercial buildings, important public utilities, main highways, or railroads could occur.

Class "a" dams are planned to have the least amount of floodwater retarding storage, class "b" dams contain intermediate storage, and class "c" dams the greatest amount of storage. Having less storage, class "a" dams have the greatest potential to be overtopped by extreme floods. Class "c" dams are planned to safely pass the maximum probable flood without overtopping but could fail from other causes, and would pose greater danger in case of failure. Other things being equal, failure of a dam with greater storage can cause more damage than one with lesser storage.

Overtopping is just one type of failure; any dam can fail for other reasons unless properly designed, constructed, operated, and maintained. Examples of the most common failures listed in the order most likely to occur, based on historical records (Engineering News Record, May 8, 1980) are: leakage (piping), outlet works damage, slope instability, inadequate slope protection, overtopping, deterioration, and embankment deformation.

A breach analysis was made for each dam included in this plan to estimate the maximum area downstream that might be flooded if the dam should fail. Based on this, each dam has been assigned a hazard classification as shown in Table 3. SCS has classified all six dams as class "a" dams. Some buildings at Peabody will continue to flood after project installation because a major drainage area entering Doyle Creek at Peabody will still be uncontrolled.

COSTS

Total project cost is $2,577,900, of which $490,000 will be borne by local funds and $2,087,900 by P.L. 566 funds. The agreement shows actual cost-sharing between P.L. 566 and other funds. The P.L. 566 funds include $1,360,800 for dam construction and mitigation costs; $476,100 for engineering services; and $204,100 for project administration. Local costs include $238,300 for land rights and $8,600 for project administration. All costs reflect 1990 price base. Estimated costs are shown in Table 1.

Structural measure costs are summarized in Table 1. These costs are shown by individual dam in Table 2.

Construction costs are direct costs for installation of structural measures. Construction includes such items as earth embankment, excavation, riprap, reinforced concrete, reinforced concrete pipe, wildlife habitat compensation measures, seeding, and fencing.

Engineering services costs for structural measures include all direct and related costs of surveys, geologic investigations, soil mechanics testing and analysis, designs, plans, and specifications.

Land rights costs are direct and related costs for the right to install, operate, and maintain works of improvement. These costs include land purchases, easements, agreements, permits, and modifications of properties and utilities. Land values were determined by the Doyle Creek Watershed board with SCS concurrence. Land rights cost estimates are based on current land values that vary from $200 per acre for woodland and miscellaneous land to $600 per acre for flood plain cropland. Land rights cost estimates may exceed actual expenses because some land rights may be donated. Land rights for about 1,219 acres are needed for the floodwater retarding dams.

Relocation costs include all payments and services provided according to the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970. The sponsors and SCS expect that no relocations will occur. However, the

Agreement contains provisions for sharing relocation costs should they occur.

Project administration costs include contract administration, review of engineering plans prepared by others, construction inspection, and relocation assistance advisory services.

Cost sharing between P.L. 566 and other sources is shown in the Agreement. Cost sharing for individual dams is shown in Table 2.

INSTALLATION AND FINANCING

Works of improvement will be installed in an 8-year period following authorization of federal assistance under P.L. 566. Table Q shows anticipated cost by fiscal year for structural measures.

Table Q - Distribution of Project Costs by Fiscal Year for Structural Measures

Fiscal Year	P.L. 566	Other	Total
1	--	123,900	123,900
2	--	123,000	123,000
3	105,300	--	105,300
4	105,300	--	105,300
5	105,300	--	105,300
6	601,200	--	601,200
7	620,500	--	620,500
8	503,400	--	503,400
Total	2,041,000	246,900	2,287,900

Doyle Creek Watershed Joint District No. 86 has the necessary authority to finance and install its portion of the planned project. This includes the right to accept contributions, levy taxes, make assessments against benefited land, issue bonds, and exercise the right of eminent domain. The watershed district has agreed to use these powers as needed.

Expenses of organizing the watershed district have been paid and current general expenses are being met by an annual ad valorem tax. Future expenses of the sponsors will be paid from funds on hand, funds to be collected through taxes, or through the issuance of general obligation bonds.

P.L. 566 funds for construction of structural measures will be provided to the watershed district through project

agreements with the SCS. Funds transferred to the sponsors by these agreements are subject to the Office of Management Budget Circular A-102. A project agreement will generally be prepared for each construction contract.

Prior to making agreements that obligate funds of the SCS, the watershed district must certify to having a financial management system for adequate control, accountability, and disclosure of P.L. 566 funds received, and for control and accountability for property and other assets purchased with P.L. 566 funds. The watershed district board will be required to develop an acceptable code of conduct for its members. The watershed district will pay its own contract administration costs.

Federal technical assistance, engineering services, project administration, and funds for construction are contingent upon appropriations for these purposes.

The ongoing program will be continued in the watershed as it would have been without project action. Land treatment measures agreed to according to the 1985 Farm Bill will be installed with funds other than P.L. 566.

Procurement methods can include formal sealed bidding contracts, small purchase contract (less than $10,000), force account, and performance of work. Agreements and contracts made by sponsors or individuals with SCS will describe the procurement method, installation arrangements, method of payment, and operation and maintenance requirements. Non-cost-shared management practices will be required as a condition for cost-sharing when they are necessary to achieve project objectives.

Installation costs of forestry land treatment will be borne by individual landowners and other federal and state programs. The cost of accelerated technical forestry assistance will be borne by P.L. 566 through Kansas State and Extension Forestry cooperating with the U.S. Forest Service.

The SCS will provide technical assistance for application of wildlife habitat measures for mitigation. The Kansas Department of Wildlife and Parks will also provide technical assistance as resources permit.

Administration will be shared by landowners, the watershed district, conservation districts, and SCS. Additionally, any agency offering an assistance program for land treatment will administer its own program.

The watershed district will develop, and keep current throughout project installation, a schedule of dam installation. The schedule will identify when each dam is to be

installed with particular detail on the current year and following two years. Distribution of project costs by year was based on Dam Nos. 6, 10, and 11 being constructed first in the same year followed by Dam Nos. 5 and 102 the next year and 101 the last year of a three-year construction period. Land rights are to be acquired the first two years followed by three years of engineering design.

The watershed district will employ a Contracting Officer and contract for construction of floodwater retarding dams. Construction contracts will be awarded on the basis of competitive bidding. Contracting will begin when land rights have been obtained, land treatment certifications are made, P.L. 566 funds and technical assistance are available, approved drawings and specifications have been developed, and the necessary construction permits obtained. The SCS will furnish engineering services for the floodwater retarding dams and upon request will also provide contracting assistance.

The watershed district will furnish legal services and obtain all land rights needed for installation of floodwater retarding dams. The sponsors will maintain a land rights schedule showing status of land rights for each planned dam in the watershed. The sponsors will also make arrangements to abandon, move, or modify roads and utilities where necessary.

CULTURAL RESOURCES

Personnel involved in project installation will be trained to identify and watch for cultural resources (buildings, structures, or artifact type materials that may contain information important to history or prehistory). If cultural resources are found during construction, SCS procedures for their protection will be followed.

OPERATION, MAINTENANCE, AND REPLACEMENT

Operation is the administration, management, and performance of any services needed to ensure proper functioning of the measure throughout its evaluated life. This includes such items as periodic inspections, reports, and other needed labor.

Maintenance can be divided into annual and periodic maintenance of project measures. Annual maintenance is the regular service required on the measure to prevent deterioration and ensure its effectiveness. It includes controlling growth of undesirable vegetation; management of grass cover such as mowing, controlled grazing, and fertilization; and cleaning trash racks.

Periodic maintenance is required on a recurring basis but less often than annually. Periodic maintenance includes spot re-vegetation, fence repair, and the more complex and costly work required to repair concrete, steel, or earthen parts of measures. Repair of damages to completed measures caused by normal deterioration, vandalism, drought, or flooding caused by rainfall in excess of design rainfall is considered maintenance regardless of whether it occurs immediately or several years after a measure is installed or established.

Replacement is required when a component has a shorter life span than the project evaluation period and must be replaced with a new item to ensure its continued effectiveness. Replacement could also be required when a major storm causes such severe damage that the component can no longer function properly. Replacement can include significant erosion repair, repair of emergency spillways, and replacement of principal spillway pipes.

Technical assistance for operating and maintaining forestland improvement measures will be provided by Kansas State and Extension Forestry in cooperation with the Forest Service. Average annual operation and maintenance costs include the following: harvesting, manufacturing, and retailing forest products; fire protection; and training fire fighting personnel.

Operation and maintenance agreements will be made by SCS with the Doyle Creek Watershed District for the floodwater retarding dams. The agreements will provide for the district to operate and maintain project dams and related wildlife habitat or other vegetation according to operation and maintenance plans to be developed with SCS technical assistance. The agreements will be signed before land rights, relocation, or project agreements are signed. They will be based on the SCS National Operations and Maintenance Manual. Emergency action plans will be included where appropriate.

Table 4 itemizes the estimated annual operation and maintenance cost for the floodwater retarding dams and forestland treatment.

Doyle Creek Watershed Joint District No. 86 will be responsible for maintaining drawdown control valves and passing natural stream flow through all P.L. 566 floodwater retarding dams to meet downstream water rights as provided by the Kansas Water Appropriation Act. The watershed district will open drawdown control valves as necessary for pool drainage for operation and maintenance.

Each dam will be jointly inspected by SCS and the watershed district immediately after initial filling and

annually thereafter by the watershed district. The inspection team is to: review hazard classification, assess O&M adequacy, identify unsafe conditions, and specify work needed. A qualified engineer will assist during or immediately following the occurrence of major events, such as floods or earthquakes, and with annual inspections for the first three years. Formal inspections are to be conducted under the leadership of a qualified engineer at least once every five years for class "b" and "c" dams (see Table 3) if any of the dams are reclassified as "b" or "c" dams during the construction phase.

Items of inspection will be listed in the Plan of Operation and Maintenance and will include, but not be limited to, the principal spillway and its appurtenances, emergency spillway, dam, vegetation on the dam and emergency spillway, fences installed as part of the project, and wildlife habitat measures. Records of inspection will be kept by the watershed district. The watershed district will be responsible for access to conduct the inspections.

Access to the floodwater retarding dams will be controlled by landowners except as necessary for inspection, operation, and maintenance. The watershed district will notify landowners and the Kansas Department of Health and Environment of the need for sanitary facilities if significant recreational use occurs. If significant recreational use occurs, water quality monitoring may be required during the swimming season. The Kansas Department of Health and Environment will provide technical assistance to control disease-producing organisms.

TABLE 1 - ESTIMATED INSTALLATION COST

Doyle Creek Watershed, Kansas

Installation Cost Item	Unit	Number	Estimated Cost (Dollars) a/						TOTAL
			P.L. 566 Funds			Other Funds			
			SCS b/	FS b/	Total	SCS b/	FS b/	Total	
FORESTRY LAND TREATMENT									
Tree Planting	ac.	600	--	--	--	--	203,700	203,700	203,700
Timber Stand Improvement and Other Practices	ac.	960	--	--	--	--	27,700	27,700	27,700
Technical Assistance				46,900	46,900		11,700	11,700	58,600
Subtotal Forestry Land Treatment				46,900	46,900		243,100	243,100	290,000
STRUCTURAL MEASURES									
Floodwater Retarding Structures	ea.	6	2,041,000	--	2,041,000	246,900	--	246,900	2,287,900
TOTAL PROJECT			2,041,000	46,900	2,087,900	246,900	243,100	490,000	2,577,900

a/ Price Base: 1990
b/ Agency responsible for the installation of works of improvement

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TABLE 2 - ESTIMATED COST DISTRIBUTION

Doyle Creek Watershed, Kansas

(Dollars) a/

Item	Installation Cost - P. L. 566 Funds				Installation Cost-Other Funds			Total Installation Cost
	Construction	Engineering Services	Project Adm.	Total P. L. 566	Land Rights	Project Adm.	Total Other	
Floodwater Retarding Structures								
5	216 600	75,800	32,500	324,900	45,600	1,500	47,100	372,000
6	184,400	64,500	27,700	276,600	29,300	1,300	30,600	307,200
10	171,000	59,800	25,600	256,400	27,500	1,300	28,800	285,200
11	116,100	40,600	17,400	174,100	16,400	1,000	17,400	191,500
101	402,700	140,900	60,400	604,000	80,000	2,000	82,000	686,000
102	270,000	94,500	40,500	405,000	39,500	1,500	41,000	446,000
TOTAL	1,360,800	476,100	204,100	2,041,000	238,300	8,600	246,900	2,287,900

a/ Price base 1990

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TABLE 3 - STRUCTURAL DATA

DAMS WITH PLANNED STORAGE CAPACITY

Doyle Creek Watershed, Kansas

ITEM	UNIT	STRUCTURE NUMBER						TOTAL
		5	6	10	11	101	102	
Hazard Class		a	a	a	a	a	a	
Seismic Zone		1	1	2	2	2	1	
Total Drainage Area	Sq. Mi.	4.46	2.95	3.02	1.60	15.80	6.80	34.63
Runoff Curve No. (1-day)(AMC II)		80	81	81	81	82	79	
Time of Concentration (Tc)	Hrs.	1.6	1.4	1.4	1.2	5.3	3.1	
Elevation Top of Dam	Ft.	1,411.4	1,433.0	1,483.0	1,464.4	1,332.3	1,349.8	
Min. Easement Elev. 100-yr.24 hr.storm	Ft.	1,408.3	1,429.4	1,479.5	1,460.6	1,328.0	1,346.1	
Elevation Crest Emergency Spillway	Ft.	1,406.4	1,428.0	1,478.0	1,459.4	1,327.0	1,343.8	
Elevation Inlet Principal Spillway	Ft.	1,398.3	1,419.5	1,470.3	1,452.4	1,302.4	1,328.0	
Maximum Height of Dam	Ft.	30.2	30.4	28.9	29.2	58.4	38.8	
Volume of Fill	Cu. Yds.	92,300	86,200	88,000	39,700	181,300	109,500	597,000
Total Capacity a/	Ac. Ft.	1,125	796	807	420	4,314	1,468	8,930
Sediment Submerged	Ac. Ft.	278	181	232	118	387	245	1,441
Sediment Aerated	Ac. Ft.	31	20	26	13	43	27	160
Floodwater Retarding	Ac. Ft.	816	595	549	289	3,884	1,196	7,329
Surface Area								
Sediment Pool	Acres	58	37	48	26	59	42	270
Floodwater Retarding Pool a/	Acres	162	111	105	63	328	115	884
Principal Spillway Design								
Rainfall Volume (1-day)	In.	6.1	6.0	6.0	6.0	6.2	6.4	
Rainfall Volume (10-day)	In.	9.8	9.5	9.7	9.7	10.1	10.4	
Runoff Volume (10-day)	In.	5.21	5.14	5.44	5.44	6.05	5.77	
Capacity of High Stage (Max.)	c.f.s.	58	31	61	31	201	173	
Dimensions of Conduit	In.	24	18	24	18	36	36	
Emergency Spillway-Frequency Operation	% Chance	4	4	4	4	3	3	
Emergency Spillway Type		Veg	Veg	Veg.	Veg.	Veg.	Veg.	
Emergency Spillway Bottom Width	Ft.	100	60	40	40	225	150	
Emergency Spillway Exit Slope	%	2.5	9.0	2.7	6.0	4.0	4.0	
Emergency Spillway Hydrograph								
Rainfall Volume	In.	5.8	5.8	5.7	5.8	6.8	7.1	
Runoff Volume	In.	3.60	3.70	3.61	3.70	4.70	4.68	
Storm Duration	Hrs.	6	6	6	6	6	6	
Velocity of Flow (Ve)	Ft./Sec.	0	2.6	0	2.1	2.0	5.3	
Max. Reservoir Water Surface Elev.	Ft.	1,406.4	1,428.0	1,478.0	1,459.6	1,327.3	1,346.0	
Freeboard Hydrograph								
Rainfall Volume	In.	8.4	8.4	8.3	8.3	10.9	11.3	
Runoff Volume	In.	6.00	6.17	6.03	6.07	8.67	8.64	
Storm Duration	Hrs.	6	6	6	6	6	6	
Max. Reservoir Water Surface Elev.	Ft.	1,408.9	1,430.6	1,480.8	1,461.7	1,332.3	1,349.8	
Outflow per Foot of Width (Qe/b)	A.F./Ft.	4.5	5.5	6.3	3.9	13.6	11.1	
Bulk Length	Ft.	550	375	550	367	780	700	
Capacity Equivalents								
Sediment Volume	In.	1.30	1.28	1.60	1.54	0.51	0.75	
Floodwater Retarding Volume	In.	3.43	3.78	3.41	3.39	4.61	3.30	

a/ Crest of emergency spillway

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TABLE 4 - ANNUAL COST

Doyle Creek Watershed, Kansas

(Dollars) a/

Evaluation Unit	Project Outlays		Total
	Amortization of Installation Cost	Operation and Maintenance Cost	
6 Floodwater Retarding Structures	200,200	6,500	206,700
Forestry Land Treatment	25,400	1,100	26,500
TOTAL	225,600	7,600	233,200

a/ Price base 1990 - All costs amortized at 8 3/4 percent interest rate for 100 years

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TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Doyle Creek Watershed, Kansas

(Dollars) a/

ON PROJECT

Item	Estimated Average Annual Damage		Damage Reduction Benefits Within the Watershed
	Without Project	With Project	
Floodwater			
Crop and Pasture	131,000	91,600	39,400
Other Agricultural	64,900	46,800	18,100
Non-agricultural			
Road and Bridge	4,200	2,400	1,800
Railroad	9,700	3,700	6,000
Urban	18,700	12,600	6,100
Subtotal	228,500	157,100	71,400
Erosion			
Flood Plain Scour	7,300	5,700	1,600
SUBTOTAL	235,800	162,800	73,000

OFF PROJECT

Item	Estimated Average Annual Damage		Damage Reduction Benefits to Cottonwood River Properties Outside the Watershed
	Without Project	With Project	
Floodwater			
Crop and Pasture	2,402,200	2,317,800	84,400
Other Agricultural	232,700	223,000	9,700
Non-agricultural			
Road and Bridge	658,900	637,400	21,500
Railroad	266,000	258,200	7,800
Urban	469,600	442,200	27,400
Scour	250,500	241,800	8,700
Traffic Interruption	2,200	2,200	0
SUBTOTAL	4,282,100	4,122,600	159,500

GRAND TOTAL

GRAND TOTAL	4,517,900	4,285,400	232,500

a/ Price base: 1990 current normalized prices (July 1990) for crop and pasture; all other values are based on 1990 prices

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TABLE 6 - COMPARISON OF RECOMMENDED PLAN BENEFITS AND COSTS

Doyle Creek Watershed, Kansas

(Dollars) a/

Evaluation Unit	Average Annual Benefits							Total Costs c/	Benefit: Cost Ratio d/
	On Project b/				Off Project b/		Total Benefits		
	Flood Damage Reduction	More Intensive Use	Stream Fishery	Forestry Land Treatment	Flood Damage Reduction	Sediment Deposition			
6 Floodwater Retarding Structures	73,000	6,700	4,100	--	159,500	18,400	261,700	207,700	1.27:1
Forestry Land Treatment	--	--	1,000	32,800	--	1,100	34,900	26,500	1.32:1
TOTAL	73,000	6,700	5,100	32,800	159,500	19,500	296,600	233,200	1.27:1

a/ Price base 1990
b/ On project is within the watershed boundary and off project in the Cottonwood River flood plain.
c/ From Table 4
d/ Total average annual equivalent benefits are $180,600; total average annual equivalent costs are $146,500; for an average annual equivalent benefit-cost ratio of 1.23 to 1.0.

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EFFECTS OF RECOMMENDED PLAN

A review of Table F on page 20 shows that the recommended plan will have a major impact on flooding, water quality, sedimentation, and agricultural income. It will have a moderate impact on volume of stream flow, land use, prime farmland, fish habitat, and wildlife habitat. The recommended plan will also have minor impacts on mineral resources, drainage, visual resources, wetlands, air quality, wild fires, and recreation; however, these factors were of little significance to decision making. The project will have a minor impact on ground water and no impact on cultural resources, endangered or threatened plants and animals, minority populations, or relocation of people or farm operations. Rationale for not discussing a factor in the section was given in the Significant to Decision Making section. Monetary value of benefits and costs are included in Tables 5 and 6, pages 61 and 62. Table X, page 71, shows the effects of the recommended plan on resources of principal national recognition.

Prime farmland will be increased by 445 acres. Scour damages will be reduced on 600 acres.

Floodwater retarding dams will improve water quality because large volumes of sediment will be trapped by the dams and flood flows will be significantly reduced.

FLOODING AND STREAM FLOW RELATED IMPACTS

Installation of the project will cause less variation in stream flow. The structures will reduce high-flow peaks while prolonging discharge after storms. Seepage and prolonged discharge from reservoirs will contribute to stream base flows and the duration of low flows will increase. Streams will be dry less often although changes of stream classification are not expected. The volume of flow from the watershed will be minimally affected by the evaporation losses from the sediment pools. The overall stream flow will be enhanced by reducing the high flow peaks and extending the duration of the low flows.

The six floodwater retarding dams will reduce frequency, discharge, depth, area, and velocity of flood flows. Table R shows reduction of peak discharges and frequency of flooding with and without the project. See Appendix B for reach boundaries.

Table R - Peak Reduction and Bank Full Frequencies

Reach[a/]	Location	Percent[b/] Peak Reduction	Bank Full Frequency	
			W/o Project Time(s)/ year(s)	W/Project Time(s)/ year(s)
1	E 1/2 Sec. 7-T21S-R5E	17	1/5	1/10
2	SE 1/4 Sec. 21-T21S-R4E	6	3/2	1/1
3	NE 1/4 SE 1/4 Sec. 36-T21S-R3E	11	2/1	3/2
4	SW 1/4 Sec. 4-T22S-R3E	0	5/2	5/2
5	NW 1/4 Sec. 9-T22S-R3E	24	3/2	3/4
6	SW 1/4 Sec. 11-T22S-R2E	35	5/2	2/1

a/ See Appendix B for reach locations.
b/ Average reductions for storms ranging from 1 inch to 7.8 inches of rainfall in 24 hours.

The NED plan will accomplish a 31 percent reduction in average annual flood damage on 5,690 acres. Flood plain benefited in each reach and the percentage of damage reduction by structural measures is shown in Table S. Benefits from reduced crop and pasture flood damages are 47 percent of the total watershed benefits.

Table S - Flood Damage Reduction

Evaluation Reach	Flood Plain a/ Benefited (acres)	Reduction in Average Annual Damages (percent)
1	1,160	23
2	850	8
3	1,210	23
4	220	0
5	1,030	44
6	1,220	34
Total	5,690	31

a/ The 100-year flood plain includes channels.

Installation of the project will allow farmers to plant higher income crops in areas that are now planted with flood-resistant crops. This shift in cropping pattern will also be accompanied by an increase in yield to acres that, with the project in place, will be out of the flood plain. These flood-protected acres will be more intensively cultivated. More intensive use benefits are about 8 percent of the total watershed benefits.

Flood damage reduction will affect to some degree all of the 2,200 people living in the watershed. All or parts of 40 farm units located in the flood plain will be directly affected by the project. Flood damages to homes, businesses, and public buildings at Peabody will be reduced by about 33 percent. This benefit category makes up 7 percent of the total watershed benefits.

Installation of the project will decrease flood damages to fences, livestock, and permanent facilities constructed on the flood plain. Cleanup of debris after each flood and harvesting costs associated with sediment damage will be reduced by the project. Dirt from floodwater in the harvested grain will also be reduced. These "other agricultural" benefits will amount to 22 percent of the total watershed benefits.

Installation of the project will reduce road and bridge maintenance costs through reduced flood flows. Doyle Creek Watershed has 12 bridges downstream from dam sites that will be directly affected by the structures.

Transporting, processing, and marketing of agricultural commodities will be more dependable and convenient. Crop losses will be reduced. Increased farm income will benefit local retailers. More goods and services will be used on the farm to get greater benefits from increased production potential.

Frequent closing, damage to, and loss of use of flood plain roads due to flooding will be reduced.

Road and bridge damage reduction benefits are 2 percent of the total watershed benefits.

EROSION AND SEDIMENTATION RELATED IMPACTS

Flood damage reduction benefits from reduced sediment are about 5 percent of the total watershed benefits.

The trapping of sediments, other solids, and other pollutants in the impoundments created by this project will reduce the amounts of these substances in downstream waters. The effect of storm-flow concentrations of nutrients, bacteria, sediment, and other suspended solids will be reduced. Generally, there will be a decrease in BOD and bacteria levels. Stream temperatures will not change significantly.

The completed project will reduce sediment yield by 23 percent at the mouth thereby improving water quality to 63

miles of perennial stream. Reduced sediment loads due to the project will improve fish habitat quality and make stream fishing more attractive.

Table T - Sediment Deposition
(tons per year)

	Alternative 1 (future w/o)	Alternative 2 (NED)
Ponds	7,400	6,500
Ditches	27,900	20,000
Flood Control Structures	6,500	25,300
Stream	2,800	3,800
Terraces	19,300	20,000
Other Land Treatment	3,200	7,200
Stay on Fields	65,100	67,900
Flood Plain	800	400
Out of Watershed (John Redmond)	93,100	80,900

Decreased sediment load, if the only parameter affected, would increase the potential to erode stream channels. However, peak discharges and average flow velocities will also be reduced. Channel stability examinations indicate degradation may occur for a very short distance below the floodwater retarding dams after construction because of the reduction in suspended sediment. This degradation will continue for a short time until the channel slopes reach stable values for the new conditions. Redistribution of bedload supply, channel slope flattening, changed hydraulic parameter, and the presence of bedrock will prevent excessive channel degradation. Little, if any, change is anticipated by observation of other watersheds in the vicinity under similar conditions.

The project will reduce flood plain scour and improve the productive capability of 5,690 acres. Benefits from reduced flood plain scour damages amount to 2 percent of the total watershed benefits.

The Diamond Creek, Doyle Creek, Eagle Creek, Middle Creek, Peyton Creek, and South Fork formulated structural systems will store 6,705 acre feet of sediment over a 100-year period. Based on the design rate of sedimentation, this upstream sediment storage will extend the life of John Redmond Reservoir by almost 13 years. The beneficial reservoir's use for recreation and fish and wildlife will be enhanced and extended. Flood prevention, water quality, and water supply beneficial effects will be extended for 13 more years. The discounted value for these five purposes is approximately $77,200 per year. About 28 percent of this

total stems from the effects of Doyle Creek floodwater retarding structures. Doyle Creek sediment storage will extend the reservoir's life about two years.

LAND USE AND PRIME FARMLAND IMPACTS

Land use with the project in place is shown in Table U. See Tables G and H for a comparison of present and projected without project land use estimates.

Table U - Future Land Use With Project

Land Use	100-year Flood Plain		Upland		Total	
	%	Acres	%	Acres	%	Acres
Cropland	74	4,220	43	35,740	45	39,960
Grassland	4	210	48	40,140	45	40,350
Forestland	17	970	2	1,760	3	2,730 a/
Other Land	2	130	5	4,560	5	4,690 b/
Stream Channel and Ponds	3	170	2	1,510	2	1,680
Total	100	5,700	100	83,710	100	89,410

a/ Includes 19 acres of forestland established for compensation (see Table II, Appendix C, for discussion of options).
b/ Includes 65 acres of dams and spillways seeded to native grass and managed for wildlife habitat compensation.

The six dams will directly change land use as shown in Table V. Table I, Appendix C, shows acreage by dam site.

Table V - Land Use at Floodwater Retarding Dams (acres)

Project Land Use	Present Land Use			Total
	Crop-land	Grass-land	Forest-land	
Dams and Spillways	18	32	15	65
Sediment Pools	84	164	22	270
Detention Pools	338	531	15	884
Total	440	727	52	1,219

At maximum flood detention, a total of 884 acres will be inundated. Individual detention pools will be filled an average of once every 25 years or less frequently (see Table 3).

Reduced flooding on 5,690 acres will result in about 540 acres being classed as prime farmland. Structures will occupy 95 acres of existing prime farmland. A net increase of 445 acres of prime farmland will result. Additionally, 3,167 acres of existing prime farmland will benefit from reduced flooding and reduced erosion.

FISH AND WILDLIFE IMPACTS

Reservoirs will replace 270 acres of terrestrial habitat with aquatic habitat and dams will modify an additional 65 acres of terrestrial habitat. The creation of a permanent water source will be beneficial to some wildlife. Each dam and spillway will be seeded with a native grass mixture, fenced, and managed for wildlife.

Sponsors will compensate for all forestland wildlife habitat losses caused by dams. Wildlife habitat changes induced by the project are summarized in Table V. Habitat losses are shown for each proposed dam in Tables I and II, Appendix C. Table II also shows alternative compensation methods and resulting areas needed to achieve compensation. Table W summarizes total watershed habitat units with and without the project.

The installation of P.L. 566 dams will partially offset the demand for stream fishing. However, reservoir fishing and stream fishing are two different types of fishing opportunities. There will be more opportunity for reservoir fishing with the project dams installed. Fishing opportunities as a whole will increase in the watershed with the project.

The increase in lake fishing at these dams has not been determined, but stream fishery has been evaluated. Installation of the six dams and forestland treatment will improve the fishing opportunities within the watershed by 280 angler days per year and 510 angler days for the 128-mile segment of the Cottonwood River which represents an increase of 790 angler days per year.

The reduction of sediment and phosphorus will reduce algae blooms and increase stream aesthetics. More uses will be made of the streams other than fishing.

Table W - Impact on Wildlife Habitat at Six Floodwater Retarding Dams

Habitat Type	Habitat Value [a/]		
	Loss Before Compensation	Compensation	Net Change
Total Riparian and Upland Forestland	255.6	255.6	0
Grassland	787.9 [b/]	650.0	- 137.9
Cropland	384.0	0	- 384.0
Total Herbaceous	1,171.9	650.0	- 521.9

a/ Value listed in habitat units. Habitat units equal rated quality (value 1 to 10) multiplied by acres. See Table I, Appendix C. These calculations were made from data collected by the Tri-agency Team in 1990. 9/

b/ Category includes rangeland and pastureland.

No adverse impacts are expected on any threatened or endangered species. Formal consultation on the Neosho madtom has been completed with the U.S. Fish and Wildlife Service. A biological assessment by the Soil Conservation Service concludes that the project would have no adverse impact on the Neosho madtom. The F&WS's biological opinion states "no jeopardy" regarding the project's impacts on the species. This opinion is contingent upon monitoring habitat and biological conditions related to the fish at gravel bar(s) near the confluence of the Cottonwood River and South Fork Watershed near Cottonwood Falls (65 miles downstream from Doyle Creek's confluence with the Cottonwood River).

WATER QUALITY

The NED Plan will have a major effect on water quality; however, contact and non-contact recreational activities will still be impaired.

Sediment will be reduced by 23,100 tons per year which represents a 52 percent reduction from present conditions. Organic matter will be reduced by 34 percent and phosphorus will be reduced by 43 percent or 20 tons. Nitrates will be reduced by 20 percent. The project will not have any effect on fecal bacteria. The plan does not fully meet the water quality goals.

WETLANDS

The project will result in the loss of two acres of wetland at Dam No. 6. The loss will be more than offset by the creation of wetland at the six reservoirs built with the project.

FORESTLAND

The forestland treatment plan includes planting 200 acres of buffer strips along Doyle Creek and its tributaries plus reinforcement of about 300 acres. These buffer strips will create a more suitable climate for aquatic life by shading the streams during summer and increasing the water temperature in the winter. Travel lanes for wildlife will increase and overall wildlife habitat will improve. More sediment nutrients and pesticides will be trapped in these trees. Streambank stabilization will increase on about 12.5 miles of stream. Greater recreational opportunities and aesthetic diversity will be increased.

Woodlands with vigorous, fully stocked stands of trees and undisturbed ground cover will slow runoff and improve soil water intake. Windbreaks and shelterbelts will break up wind and assist in reducing erosion and provide added wildlife habitat.

OTHER IMPACTS

Installation of the project will provide 23 man-years of employment during the 8-year installation period. Operation and maintenance of the structures will provide 0.4 man-years of employment annually.

No cultural resources eligible for listing or being considered for the National Register of Historic Places will be affected by the project. 8/

OFF-SITE BENEFITS

Off-site benefits are significant to this watershed project. They are in two categories: (1) flood damage reduction benefits to the 50,000 acres Cottonwood River flood plain, and (2) sediment reduction to John Redmond Reservoir. See Appendix C, Investigation and Analysis Report, for the distribution of flood damage reduction benefits to Doyle Creek. Doyle Creek will extend the useful life of John Redmond Reservoir about three years. In combination with other P.L. watersheds, the total effect is about 13 years.

Table X - Effects of the Recommended Plan on Resources of Principal National Recognition

Types of Resources	Principal Sources of National Recognition	Measurement of Effect
Air quality	Clean Air Act, as amended (42 U.S.C. 185th-7 et seq.).	No effect
Areas of particular concern within the coastal zone	Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1451 et. seq.).	Not present in planning area
Endangered and threatened species critical habitat	Endangered Species Act of 1973, as amended (16 U.S.C. 1531) et.seq.)	No effect
Fish and wildlife habitat	Fish and Wildlife Coordination Act (16 U.S.C. Sec. 661) et. seq.).	Creation of 270 surface acres, converts 2.6 miles of intermittent stream and 2.4 miles of perennial stream to surface water habitat
Flood plains	Executive Order 11988, Flood Plain Management	250 acres removed from 100-year flood plain
Historic and cultural properties	National Historic Preservation Act of 1966, as amended (16 U.S.C. Sec 470 et seq.).	No effect
Prime and unique farmland	CEQ Memorandum of August 1, 1980: Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act, Farmland Protection Policy Act of 1981	95 acres lost; 540 acres protected and and reclassified as prime farmland
Water quality	Clean Water Act of 1977 (33 U.S.C. 1251 et seq.).	Move stream water quality closer to meeting water quality standards but does not meet the standards
Wetlands	Executive Order 11990, Protection of Wetlands Clean Water Act of 1977 (42 U.S.C. 185th-7, et seq.).	Two acres lost. Area created greater than loss
Wild and scenic rivers	Wild and Scenic Rivers Act, as amended (16 U.S.C. 1271 et seq.).	Not present in planning area

RELATIONSHIP TO OTHER PLANS, POLICIES, AND CONTROLS

Doyle Creek Watershed is an element of the Arkansas-White-Red River Basin Management Plan. The plan serves as a definitive, flexible guide for the development, conservation, preservation, and management of water and related land resources in the basin. Doyle Creek Watershed is in the Arkansas-White-Red River Basin Water Resources Council Area 11070202.

Kansas legislature appropriated a state Non-point Source Pollution Control Fund. Money from this fund is available to groups after they develop a non-point source management plan. A management plan has been written for this watershed by the Marion County Conservation District. This management plan is a comprehensive plan for the watershed and includes the PL-566 dams shown in this watershed plan.

CONSULTATION AND PUBLIC PARTICIPATION

The Peabody Kiwanis Club sponsored the first watershed meeting in March of 1968. This meeting concluded with a decision to organize a steering committee which was appointed in April 1968 to direct the organization of a watershed district. Formal incorporation and organization of the Doyle Creek Watershed was granted by the Kansas Secretary of State on April 2, 1970.

Doyle Creek Watershed Joint District No. 86 submitted a P.L. 566 application to SCS June 7, 1972. This application was filed with the Governor's Watershed Review Committee on July 10, 1972. A Field Examination Team and other interested individuals toured the watershed noting problems and identifying solutions. The Field Examination Team was composed of representatives from the State Conservation Commission, Kansas Water Resources Board (now Kansas Water Office), Division of Water Resources of the Kansas State Board of Agriculture, Extension Service, and Soil Conservation Service. An afternoon watershed tour and an evening public meeting were held October 10, 1972, to review the watershed problems and solutions identified by the Field Examination Team. The Watershed Review Committee gave the watershed a 68 rating and approved the watershed application on October 30, 1972.

Initial planning results were presented to sponsors in a Preliminary Watershed Investigation Report in March 1968. The Soil Conservation Service provided a limited amount of technical assistance to the district until 1988. At that time the SCS requested the State of Kansas to identify additional watersheds for planning priority.

The Watershed Review Committee asked the district to hold a public meeting where an update of the Field Examination Team's reported damages and solutions could be discussed and local public interest determined. This public meeting was held February 2, 1988. The public generally supported the flood control projects and asked the board to proceed with planning.

The Corps of Engineers conducted a reconnaissance study of all watershed dams within the Upper Grand (Neosho) River and Tributaries above John Redmond Reservoir remaining to be built which was released in July 1987. When the Doyle Creek Watershed Board began updating their data base, the Corps of Engineers, Tulsa District, explained the data that they had collected and provided copies to the Soil Conservation Service. These data were used in the watershed analysis.

The General Plan cost and benefit data were updated to a 1988 price base. From this benefit-cost data the board selected potential dams for detailed studies.

At about the same time, SCS and the Kansas Department of Health and Environment (KDHE) began collecting and analyzing water samples from Doyle Creek and its tributaries. The results of these water quality studies were made public at a pre-authorization meeting held December 7, 1989. Following this public meeting a water quality public meeting was held April 17, 1990. After these meetings, the board requested planning authorization which was approved April 25, 1990.

Representatives from SCS, Kansas Department of Wildlife and Parks, and U.S. Fish and Wildlife Service conducted a wildlife habitat assessment for six potential dams April 2-4, 1990. A tri-agency report was prepared showing inventory data, habitat losses, and alternative ways to mitigate habitat losses. During 1991 this tri-agency report was supplemented to include the wildlife habitat assessment for Dam No. 5.

SCS consulted with U.S. Fish and Wildlife Service representatives regarding occurrence of endangered species in the project area. They provided by letter dated August 18, 1989, a list of the species likely to be found in the watershed. Consultation has been completed with the U.S. Fish and Wildlife Service regarding the Neosho madtom.

Investigations are currently underway to verify project impacts on unknown cultural resources.

A Forestry Plan was developed by Kansas State and Extension Forestry. Local farmers and ranchers were involved in the planning process although proposed planning practices were not identified specifically to a farm or ranch. Forestland treatment water quality effects were important in plan formulation.

A Water Quality Preliminary Report, prepared by the Kansas Department of Health and Environment, was released in January 1990. This report included results of water sampling at the mouth of Doyle Creek, as well as selected upstream samples taken during high water events; the state stream standards; and recommended plan to meet the state's standards.

Since the Doyle Creek Watershed was organized, the district board has carried out a regular information program to keep the public informed. Frequent person-to-person contacts have been made to help explain the project and to ask for input to the planning process. Monthly meetings have been open to the public. Annual meetings are advertised in advance in the principal county newspapers. Special invitations have been sent to farmers and ranchers notifying them of selected meetings where water quality and related issues have been discussed.

List of agencies, conservation groups, and organizations to whom copies of the draft plan were sent for comment:

Federal:

- Department of Agriculture
  - Agricultural Stabilization and Conservation Service
  - Farmers Home Administration
  - Forest Service
  - Office of Equal Opportunity
- Department of Army
  - Chief of Engineers
  - District Engineer
- Department of Commerce
  - Ecology and Conservation Division
  - River Forecast Center
- Department of Housing and Urban Development
- Department of the Interior
  - Bureau of Indian Affairs
  - Bureau of Mines
  - Bureau of Reclamation
  - Fish and Wildlife Service
    - Regional Director
  - Geological Survey
  - National Park Service
  - Office of Environmental Project Review
  - Secretary of the Interior
- Environmental Protection Agency

State:

- Biological Survey
- Department of Health and Environment
- Department of Transportation
- Department of Wildlife and Parks
- Division of Budget
- Governor of Kansas
- Kansas State University
  - Dean of Agriculture
  - Department of Agronomy
- Kansas Water Office
- State Board of Agriculture
  - Division of Water Resources
  - Secretary
- State and Extension Forestry
- State Conservation Commission
- State Historical Society
- Geological Survey

Other:

- Friends of the Earth
- Kansas Chapter Wildlife Society
- Kansas Ornithological Society

Other, continued
Kansas Wildlife Federation, Inc.
National Audubon Society
National Wildlife Federation
Natural Resources Defense Council
Sierra Club (national level)

Local:
Conservation Districts
Watershed District

LIST OF PREPARERS AND QUALIFICATIONS

DOYLE CREEK WATERSHED PLAN AND ENVIRONMENTAL IMPACT STATEMENT

FORMAT:

Name - Present Job Title (years): Degree(s) - Major; continuing education subjects; Former Job Titles (Years of experience); other information

ROBERT H. DREES - Geologist (8); MS-Geology: BS-Geology; Geotechnology, Groundwater; SCS Engineering Geologist (5); Corps of Engineers, Field Geologist (5); Certified Professional Geologist, Virginia, No. 387; Registered Professional Geologist, Arkansas, No. 1255.

W. DUANE EVANS - SCS Agricultural Economist (24); BS-Agric. Econ., MS-Agric. Econ.; statistics, linear programming, computer science, environmental sem.

STEVEN C. HENNINGSEN - Water Resources Planning Staff Soil Conservationist (4); BS-Wildlife Conservation; District Conservationist (12); Soil Conservationist (3).

KENNETH KUIPER - SCS Biologist (1); BS-Biology; SCS State Water Quality Specialist (2); District Conservationist (4); Soil Conservationist-Water Conservation Target Team (3); Soil Conservationist (2); Conservation Technician (2).

JERRY B. LEE - SCS State Conservation Agronomist (7); BS-Agronomy; Area Agronomist (5); District Conservationist (4); Soil Conservationist (5); Soil Scientist (5); Certified Professional Agronomist No. 593.

NORMAN L. LISTER - Hydraulic Engineer (8); BS-Civil Engr.; Civil Engr. (project construction) (1); Engineering Technician (2); Soil Conservation Technician (14); Registered Professional Engineer Kansas License No. 10811.

LARRY D. MILES - SCS Water Resources Planning Staff Leader (7); BS-Civil Engr.; computer technol., engineering properties of soils; SCS Water Resources Planning Engineer (13); Construction Engineer (2), Design Engineer (5); Registered Professional Engineer Kansas License No. 5846/

H. LYNN GIBSON - Area Conservationist (5); BS-Range; Ecosystems mgt.; Environm'ental development; State Range Conservationist (9); Range Conservationist (5); District Conservationist (4); Area Range Conservationist (2).

JOHN W. REH - Assistant State Conservationist for Water Resources (6); SCS Water Resources Planning Staff Leader (14); BS-Agric. Engr.; computer sci., water resource engineering, wildlife management, environmental assessments and statements, multi-objective planning; Hydrologic Engineer (10); Design Engineer (2); Project Engineer (2); Registered Professional Engineer Kansas License No. 5023.

RICHARD L. SCHLEPP - SCS State Soil Scientist (3); BS-Agriculture; Soil Science Institute; author of two Soil Survey Publications; Assistant State Soil Scientist (3); Soil Survey Party Leader (9); Soil Scientist (2).

KIRK MILES - District Conservationist (4); BS-Agricultural Economist; Computer Science; Environmental Concepts Seminar; Agricultural Economist (8); Soil Conservationist (1/2).

GARY SCHULER - District Conservationist (13); Natural Resources Conservation and Use; Soil Conservationist (1).

LAWRENCE H. WETTER - SCS Planning Engineer (6); Hydraulic Engineer (10); BS-Agric. Engr., MS-Civil Engr. (Hydrology); hydrometeorology, dam break/dam routing, analysis of watersheds and river systems; SCS Area Agric. Engineer (2); Hydraulic Research Assistant (2); County Engineer (roads, bridges) (3); SCS Civil Engineer (project construction dams) (7); Registered Professional Engineer Kansas License No. 5325.

ROBERT D. WOOD - Wildlife Ecologist (8); BS-Wildlife Management; KDWP Environmental Liaison Biologist (12) KFGC Game Biologist (10); Certified Wildlife Biologist T.W.S.

LAURENCE D. ZUCKERMAN - Kansas Department of Wildlife and Parks Aquatic Ecologist (4); BS-Marine Ecology; MS-Environmental and Forest Biology; PHD (candidate-Fishery Biology); Fish Biologist (7); Environmental Law, Statistics, Community Ecologist; Certified for HEP U.S. Fish and Wildlife Service.

JOHN K. STRICKLER - Extension State Leader, Forestry Program (2); BS - Forestry, MS - Extension Education; Governor's Special Assistant for Environment and Natural Resources (2); Assoc. State Extension Forester (22); Area Extension Forester (4); Assistant District Ranger, Forest Service (3).

The preparers of this document include various consultants in addition to the members of the Interdisciplinary Team and the Tri-Agency Team.

Reservoir topographic maps were provided by Municipal Engineers. Municipal Engineers made hydraulic studies and bench mark surveys.

The draft watershed plan and environmental impact statement was reviewed by SC staff at the field, state, and Midwest National Technical Center levels by specialists having responsibility for engineering, soils, agronomy, range conservation, biology, forestry, geology, hydrology, economics, and recreation.

INDEX

SELECTED REFERENCES*

1. U.S. Department of Agriculture, Soil Conservation Service in cooperation with Kansas Agricultural Experiment Station. Soil Survey Harvey County, Kansas, and Marion County, Kansas, issued November 1974 and December 1983 respectively.

2. U.S. Department of Commerce, Bureau of the Census. Census of Population: 1980, Volume 1, Characteristics of the Population, Chapter A, Number of Inhabitants, Kansas, Washington, D. C. 1983.

3. Kansas Department of Health and Environment. Preliminary Water Quality Assessment, Doyle Creek Watershed, Harvey and Marion Counties, Kansas, January 1990.

4. Cooperative Extension Service, Department of Forestry, State and Extension Forestry. Forest/Woodland Resources Plan for Doyle Creek Watershed, Harvey and Marion Counties, Kansas, January 1991

5. U.S. Department of Commerce, Bureau of the Census. 1982 Census of Agriculture, U.S. Government Printing Office, Washington, D.C. October 1983.

6. The University of Kansas, Institute for Public Policy and Business Research. Kansas Statistical Abstract, 1988-1989, Lawrence, Kansas 1990.

7. Kansas Department of Health and Environment. Well test results cited in letters sent to landowners, 1990.

8. Kansas State Historical Society. Doyle Creek Archeology, Results of a Phase I Cultural Resources Survey within the Watershed, Harvey and Marion Counties, Kansas

9. Kansas Department of Wildlife and Parks, U.S. Fish and Wildlife Service, Soil Conservation Service. Tri-agency Report, 1991

10. Kansas Department of Wildlife and Parks. Letter to James N. Habiger, State Conservationist, from Robert D. Wood, Wildlife Ecologist, March 5, 1990.

* Footnote numbers appearing in the text correspond to these references.

LIST OF APPENDICES

APPENDIX A

LETTERS OF COMMENT ON DRAFT PLAN/EIS AND

RESPONSE TO COMMENTS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101

November 25, 1991

Mr. James N. Habiger
State Conservationist
U.S. Department of Agriculture
Soil Conservation Service
760 South Broadway
Salina, Kansas 67401

Dear Mr. Habiger:

RE: Review of Draft Watershed Plan and Environmental Impact Statement for Doyle Creek Watershed, Harvey and Marion Counties, Kansas

In accordance with our responsibilities under Section 309 of the Clean Air Act and the National Environmental Policy Act we have reviewed the above document and offer the following comments.

Based on our review, we assign a rating of EC-1 to this project (Environmental Concerns, Adequate). This rating reflects our Region's view that the DEIS adequately sets forth the environmental impacts of the preferred alternative, but corrective measures are recommended that can reduce the environmental impact. We believe that alternatives should be developed that represent elements of both the National Economic Development (NED) Plan and the Water Quality Plan.

Water Quality

Most of the soils in the detention pond areas are indicated as hydric on the Soil Conservation Survey maps. Because of this, a strong potential exists for wetlands to become established in the sediment storage pools. The Marion County Soil Survey indicates that 80% of the annual rainfall for the region occurs during the seven month period from April through October. We believe that retained storm water in the proposed detention basins could establish wetlands with resulting functions and values, such as increased aquatic wildlife habitat, improved water quality and recreational uses. These attributes would compliment the values of the project and help to meet the President's stated policy of "No net loss of wetlands." Because of the reasons stated above, we recommend that the sediment storage ponds be enlarged and more water retention incorporated in the proposed detention areas.

We also note that while the preferred alternative has the economic advantage over alternative number three we questio whether the preferred alternative will meet the state wate quality standards. In addition, you should be aware that th "consistency" aspect of the Kansas Non-Point Source (NPS Pollution Program will require that the project conform to thei NPS goals. Those goals will, most likely, include the implementation of NPS pollution control strategies in the watershed.

Bio-diversity

As a result of the need to better attenuate environmental impacts as they relate to natural bio-systems, we encourage yo to work with the land owners to include certain amenities in you watershed plan that will help to achieve water quality, soi erosion protection and habitat production. Your proposal t include natural vegetation for restoration of disturbed area around the retention basins is a positive step toward enhancin existing habitat. We recommend that you also incorporat riparian corridors along the streams throughout the watershe basin. These corridors will not only increase wildlife cover bu will also serve to act as filters and traps aiding in the reduction of soil loss and stream sediment loading of the adjacen stream, thus improving water quality.

If you have any questions, please write to me or call Dewayne Knott at (913) 551-7299. Thank you for the opportunity to comment.

Sincerely,

Lawrence M. Cavin
Chief, Environmental Review
and Coordination Section

cc: Don Snethen
Kansas Department of Health and Environment
Bureau of Environmental Quality
Forbes Field, Building 740
Topeka, Kansas 66620-0001

United States Department of Agriculture
Soil Conservation Service
760 South Broadway
Salina, Kansas
67401

December 11, 1991

Mr. Lawrence Cavin
Chief, Environmental Review
and Coordination Section
Environmental Protection Agency
726 Minnesota Avenue
Kansas City, Kansas 66101

Dear Mr. Cavin:

Your comments dated November 25, 1991, on the Doyle Creek Watershed Interagency Review Draft Plan/EIS are appreciated.

We would like to clarify an apparent misunderstanding about planned measures to improve the water quality in Doyle Creek. Discussions between Kathy Tortorici of your office and Larry Miles of this office indicate the need for clarification of how this project fits into the overall water quality activities in Kansas.

Watershed planning for this project identified alternatives needed to meet water quality objectives of the State of Kansas. The PL-566 plan selected by the sponsors is only a part of the water quality project for Doyle Creek. The PL-566 plan addresses about one-half of the total water quality need and state NPS and other programs address the remaining needs. In other words, the PL-566 NED plan alternative combined with the existing state programs accomplishes the optimum Water Quality Plan Alternative developed and identified through watershed planning for Doyle Creek. The PL-566 project sponsors selected the NED alternative because it is one that is socially acceptable to them and also because more efficient programs exist to deal with other aspects of the project.

We agree completely that retained storm water in the sediment and detention pools could establish wetlands and result in increased aquatic wildlife habitat. We would certainly be in favor of expanding the pool areas to increase the wetland potential if the current sponsors agree and a viable new sponsor assumes the financial commitment involved in these added features.

We believe the selected alternative represented in this plan combined with the other available programs will result in a

"consistent" approach to the Kansas NPS pollution program. Close coordination has been maintained with KDHE throughout planning to ensure project consistency. Enclosed for your information is the draft Doyle Creek NPS Management Plan that ties available programs together in a cooperative federal-state effort to accomplish good water quality in Doyle Creek.

Your concurrence in the Doyle Creek Plan/EIS is requested.

Thank you for your assistance.

Sincerely,

John N. Reh

James N. Habiger
State Conservationist

Enclosure

cc:
Ronald Fox, KHDE, Topeka, KS
John Peterson, Director, WPD, SCS, Washington, DC
August Dornbusch, Jr., Director, MNTC, SCS, Lincoln, NE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101

January 6, 1992

Mr. James N. Habiger
State Conservationist
U.S. Department of Agriculture
Soil Conservation Service
760 South Broadway
Salina, Kansas 67401

Dear Mr. Habiger:

RE: Response Letter from Soil Conservation Service Regarding the Doyle Creek Watershed Plan and Draft Environmental Impact Statement (EIS)

Regarding your letter dated December 11, 1991, we concur with these responses to our comment letter on the draft EIS. The final EIS should explain the relationship between the PL-566 plan, the NED alternative and overall water quality activities in Kansas.

Sincerely,

Lawrence M. Cavin
Chief, Environmental Review
and Coordination Section

No response necessary

U.S. Department of Housing and Urban Development

Kansas City Regional Office, Region VII
Gateway Tower II
400 State Avenue
Kansas City, Kansas 66101-2406

October 21, 1991

Mr. James N. Habiger
State Conservationist
Soil Conservation Service
760 South Broadway
Salina, KS 67401

Dear Mr. Habiger:

SUBJECT: Draft Watershed Plan and Environmental Impact Statement: Doyle Creek; Harvey and Marion Counties, Kansas (September, 1991)

This is to acknowledge that the subject draft watershed plan and environmental impact statement has been received by this office. It is being reviewed by the Environmental Officer, as follows:

Mr. Lance Long, Environmental Officer
Department of Housing and Urban Development
400 State Avenue
Kansas City, KS 66101-2406

Telephone: FTS 757-2184

Mr. Long will review the draft plan and statement and provide comments, if any, directly to you by December 1, 1991. If you do not receive a reply within this time frame you may assume we have no comments.

Sincerely,

Gary Ulfican
Regional Environmental Officer
Community Planning and
Development

No response necessary

U.S. Department of Housing and Urban Development

Kansas City Regional Office, Region VII
Gateway Tower II
400 State Avenue
Kansas City, Kansas 66101-2406

October 22, 1991

Mr. James N. Habiger
State Conservationist
Soil Conservation Service
760 South Broadway
Salina, KS 67401

Dear Mr. Habiger:

SUBJECT: Draft Watershed Plan and Environmental Impact Statement: Doyle Creek, Harvey and Marion Counties, Kansas

This office has reviewed the subject draft statement for flood control in the Doyle Creek Watershed. The document was found to be in accordance with the spirit and intent of the National Environmental Policy Act and no apparent adverse impacts were noted relating to Housing and Urban Development projects in this jurisdiction.

We appreciate the opportunity to comment.

Sincerely,

Lance L. Long
Environmental Officer
Office of Community Planning
and Development

No response necessary

United States Department of the Interior

BUREAU OF RECLAMATION
WASHINGTON, D.C. 20240

IN REPLY
REFER TO:
W-6500

NOV 8 1991

Mr. James N. Habiger
State Conservationist
U.S. Department of Agriculture
Soil Conservation Service
760 South Broadway
Salina, Kansas 67401

Dear Mr. Habiger:

Your letter of September 27, 1991, to Secretary Lujan was referred to the Bureau of Reclamation (Reclamation) for review and comment on the draft Watershed Plan/Environmental Impact Statement (EIS) for Doyle Creek Watershed, Harvey and Marion Counties, Kansas.

Reclamation has reviewed the subject draft EIS and has determine that the recommended plan proposed in the document does not affect this organization's activities. Therefore, Reclamation has no comment on the draft EIS.

Thank you for the opportunity to review this document.

Sincerely,

Lawrence F. Llewood

Acting Dennis B. Underwood
Commissioner

No response necessary

United States Department of the Interior
BUREAU OF MINES
INTERMOUNTAIN FIELD OPERATIONS CENTER
P.O. BOX 25086
BUILDING 20, DENVER FEDERAL CENTER
DENVER, COLORADO 80225

TAKE PRIDE IN AMERICA

November 14, 1991

James N. Habiger
State Conservationist
USDA - Soil Conservation Service
760 South Broadway
Salina, Kansas 67401

Dear Mr. Habiger:

Subject: Interagency Review Plan Draft, Watershed Plan and Environmental Impact Statement, Doyle Creek Watershed, Harvey and Marion Counties, Kansas

We received a copy of the draft document and thank you for giving us the opportunity to comment. Our agency's interest in such projects lies in determining whether negative impacts to mineral resources could occur during project implementation and whether such impacts have been considered during project planning. Our comments are drawn from available information, are provided on a technical assistance basis only, and may not reflect the position of the Department of the Interior. The recommended flood control plan (Alternative 2) would involve construction of 6 earthen dams, prescribed timber harvesting and tree planting, improved fire control equipment and training, and treatment of forest land for long-term stream-bank stabilization, water quality, and incidental benefits to wildlife habitat, timber, and wood products.

1 As the document notes (Table F, p. 20), oil production occurs from scattered wells in Marion County, particularly near proposed Dam No. 101. The dam is on the edge of the Florence Field which was discovered in 1920. The scale and completeness of our oil and gas maps do not allow us to answer the question of whether any wells would be inundated by the proposed reservoir. Although the document preparers (Table F, p. 20) indicate that overall mineral resource impacts of the project will be minimal, we believe it might assist project planners to check the area near the dam to determine whether the area contains producing wells, abandoned wells, or related producing facilities. If reservoir filling would inundate abandoned wells in this old field, the wells should be visited to determine whether they have been plugged properly to preclude seepage of contaminants into the reservoir. If producing wells or related facilities are inside the proposed inundation area, a discussion regarding mitigation measures such as well capping, relocation and sealing of existing gathering lines, and compensation to owners should appear in future environmental documents. At least two oil pipelines cross the project area and should be located precisely prior to construction, and plans for protecting or relocating them should be discussed if they would be inundated.

Sincerely,

Bradford B Williams

FOR Richard B. Grabowski, Acting Chief
Intermountain Field Operations Center

Response:

1 Some known wells exist downstream from Dam No. 101; but none will be affected by construction.

2 If any abandoned oil wells are subsequently found in the reservoir area, they will be properly plugged according to regulations of the Kansas Corporation Commission and the Kansas Department of Health and Environment.

DEPARTMENT OF THE ARMY
KANSAS CITY DISTRICT. CORPS OF ENGINEERS
700 FEDERAL BUILDING
KANSAS CITY, MISSOURI 64106-2896

REPLY TO ATTENTION OF

October 30, 1991

Project Compliance Section
(HV-MN, KS - General)

Mr. James N. Habiger
State Conservationist
Soil Conservation Service
760 South Broadway
Salina, Kansas 67401

Dear Mr. Habiger:

This is in reply to your letter, dated September 27, 1991, with a copy of the draft Watershed Plan/Environmental Impact Statement for Doyle Creek Watershed, Harvey and Marion Counties, Kansas enclosed requesting comments concerning construction of six floodwater retarding dams in Harvey and Marion Counties, Kansas.

The Corps of Engineers has regulatory jurisdiction over all waters of the United States pursuant to the provisions of Section 404 of the Clean Water Act (33 USC 1344), which is administered under Federal regulations 33 CFR 320-330. These provisions require prior authorization from the Corps of Engineers for the discharge of dredged or fill material into waters of the United States, including wetlands.

The regulations include a nationwide permit (NWP) that authorizes the discharge of dredged or fill material into nontidal rivers, streams, and their lakes and impoundments, including wetlands, that are located above the headwaters, such as at these locations. The NWP is subject to the following conditions being met: The activity must not cause the loss or substantial adverse modification of more than 1 acre of such waters, and the management practices listed on the enclosed copy of excerpts from 33 CFR Part 330 are followed to the maximum extent practicable, and all special conditions listed are met.

This nationwide permit (NWP) verification is valid until this NWP is modified, reissued, or revoked which is scheduled to be accomplished prior to January 13, 1992. It is your responsibility to remain informed of changes to the NWP. We will issue a public notice announcing the reissuance or changes when they occur. Furthermore, if this NWP is modified or revoked and you commence or are under contract to commence this activity before the date the NWP is modified or revoked, you would have only 12 months from that date to complete the activity under the present terms and conditions of this NWP.

If the proposed activity causes the loss or substantial adverse modification of 1 to 10 acres of waters of the United States, including wetlands, notification of the District Engineer is required, and you should contact this office in that regard. Also, if the existing activity caused the loss or substantial adverse modification of 10 acres or more of waters of the United States, including wetlands, an individual Department of the Army (DA) permit will be required.

Federal regulations require that a DA permit be issued by this office prior to the initiation of any construction on the portion of a proposed project which is within the Corps of Engineers regulatory jurisdiction.

This office is not aware of any designated wetlands within the construction areas. If there are any questions regarding wetlands being involved, this office should be contacted so that a field investigation of the area can be made.

In regard to 100-year flood plain information, the proposed dams are located within the civil works jurisdiction of the Tulsa District, Corps of Engineers. Therefore, this office assumes that the Tulsa District is furnishing the flood plain information under separate cover.

If you have any questions concerning this matter, please feel free to write me or to call Mr. Bill DeMar at 816-426-5643.

Sincerely,

for Robert H. Stevens

M. D. Jewett
Chief, Regulatory Branch
Operations Division

Enclosure

No response necessary

United States Department of the Interior

GEOLOGICAL SURVEY

Water Resources Division
4821 Quail Crest Place
Lawrence, Kansas 66049

November 21, 1991

Mr. James N. Habiger
State Conservationist
Soil Conservation Service
760 South Broadway
Salina, KS 67401

Dear Mr. Habiger:

Enclosed is the review copy of the draft Watershed Plan/Environmental Impact Statement for Doyle Creek Watershed, Harvey and Marion Counties, Kansas. As requested in your letter of September 27, 1991, this document was reviewed but limited to the technical adequacy of the water-quality components.

Generally, the document was well written and organized, but some deficiencies exist to which you may wish to give further consideration. The initial water-quality assessment of the Doyle Creek watershed appears to be limited both spatially and temporally. This office does not have a copy of the Kansas Department of Health and Environment preliminary assessment of Doyle Creek; however, samples indicated in Table E (page 16) consist of only 8 monthly baseflow samples and apparently 5 composite samples of storm runoff from 4 sites. This limited sampling raises some question as to the validity of concentrations listed in Table E from an annual average perspective. Although not indicated in the document, if composite samples of runoff were generated based solely on time intervals and in difference to streamflow, the resultant runoff concentration would not be a true representation of the average runoff concentration. For instance, for a constituent that varied directly with streamflow, the equal sample volume/equal time interval method would yield an average runoff concentration less than that determined when discrete samples are flow weighted prior to compositing. Given these facts, it is suggested that the data in Table E be qualified by indicating that the concentrations are estimated based on a limited data set. Additionally, atrazine and alachlor are shown in Table E as milligrams per liter (mg/L) instead of the correct micrograms per liter.

1

2

The limited preliminary data base and apparent lack of post-implementation monitoring suggest that the goals for constituent load reductions indicated on page 69 for the NED plan would be extremely difficult to varify. Again, it is recommended that these load-reduction figures be qualified with a statement indicating that they represent an estimate and could deviate significantly from the indicated values.

3

It is hoped that this review will be of benefit in the preparation of the final document. If you have any questions, please call Mike Pope of this office.

Sincerely,

Richard A. Herbert
District Chief

Enclosure

Response

1 We agree that the water quality assessment is an estimate based on a limited data set. We believe that the data set is adequate to conclude that Doyle Creek's water quality is impaired due to nitrates, phosphorus, suspended soils, fecal coliform bacteria, and biochemical oxygen demand and that pollution control actions are needed to correct these impairments.

The recommended water quality improvements (presented on page 38) are based on the reduction of instream pollutant concentration needed to achieve the indicated water quality criteria. While not explicitly stated, the pollutant load reductions were based on the premise that the observed water quality condition of Doyle Creek is directly related to existing pollutant load and an equivalent reduction in pollutant load will result in equivalent reduction in instream pollutant concentrations

2 We have changed the reference from milligrams per liter to micrograms per liter in Table E and other tables in the document.

3 We believe this assumption, although simplified, is adequate to determine the general magnitude of pollution control actions needed to correct the water quality impairments. In addition, it is recognized that the recommended plan is not expected to achieve the recommended level of water quality (refer to Tables M and P). The recommended plan is one element of the non-point source pollution management plan the sponsors plan to implement. The non-point source management plan is essentially the water quality alternative.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Office of the Chief Scientist
Washington, D.C. 20230

December 5, 1991

Mr. James N. Habiger
State Conservationist
Soil Conservation Service
760 South Broadway
Salina, Kansas 67401

Dear Mr. Habiger:

Enclosed are comments on the Watershed Plan and Environmental Impact Statement for Doyle Creek Watershed, Kansas. We hope our comments will assist you. Thank you for giving us an opportunity to review the document.

Sincerely,

David Cottingham
Director
Ecology and Conservation Office

Enclosure

No response necessary

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Coast and Geodetic Survey
Rockville, Maryland 20852

NOV 26 1991

MEMORANDUM FOR: David Cottingham
Ecology and Environmental Conservation Office
Office of the Chief Scientist

FROM: for Rear Admiral J. Austin Yeager, NOAA
Director, Coast and Geodetic Survey

SUBJECT: DEIS 9110.05 - Watershed Plan and Environmental Impact Statement for Doyle Creek Watershed, Kansas

The subject statement has been reviewed within the areas of Coast and Geodetic Survey's (C&GS) responsibility and expertise and in terms of the impact of the proposed actions on C&GS activities and projects.

A preliminary review of C&GS records has indicated the presence of vertical (V) geodetic control survey monuments in the proposed project area. Published geodetic control data for Kansas State Level Line 64 are provided for your reference. No horizontal geodetic control survey monuments are located in the proposed project area.

This information should be reviewed for identifying the location and designation of any geodetic control monuments that may be affected by the proposed project. If there are any planned activities which will disturb or destroy these monuments, C&GS requires not less than 90 days' notification in advance of such activities in order to plan for their relocation.

C&GS recommends that funding for this project include the cost of any relocation required for C&GS monuments. For further information about these monuments, please contact the National Geodetic Information Branch, N/CG17, Rockwall Building, room 20, National Geodetic Survey Division, NOAA, Rockville, Maryland 20852, telephone 301-443-8631.

Attachment

cc: N/CG1x35 - M. Rivers, III
N/CG17 - J. Spencer

No response necessary

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ER 91/939

NOV 29 1991

Mr. James N. Habiger
State Conservationist
Soil Conservation Service
760 South Broadway
Salina, Kansas 67401

Dear Mr. Habiger:

We have reviewed the Draft Watershed Plan/Environmental Impact Statement for Doyle Creek Watershed, Harvey and Marion Counties, Kansas. In reviewing the document, several areas of concern have surfaced.

General Comments

1 Doyle Creek is classified as a Class II, high priority fishery resource within Kansas. This is partly due to much of the watershed remaining in prairie grass and the contribution of small high quality spring-fed tributary streams. Doyle Creek, in turn, is a major tributary to the Cottonwood River which is currently State-designated critical habitat for the State and federally listed Neosho madtom (Noturus placidus). Although the Neosho madtom is not known to occupy the Doyle Creek watershed, changes in flow, particularly in peak or flushing flows, may degrade the gravel bar habitat required by this protected fish species in the Cottonwood River. Cumulative impacts by watershed developments in the headwaters to streamflows and gravel transport within the lower watershed remain a concern with both the Federal and State wildlife
2 agencies. As stated in the Fish and Wildlife Service's (FWS) June 20, 1991, biological opinion, construction in the Doyle Creek watershed must await results of monitoring studies being planned in the South Fork Cottonwood watershed.

Specific Comments

3 Page 1, Endangered and threatened species--The western prairie fringed orchid (Platanthera praeclara) should be described as a federally listed threatened species. It generally occurs in swales or low edges of slopes in natural tallgrass prairie. If it occurs in any impact area, this species needs to be addressed through a separate Section 7 consultation.

4 The paragraph concerning the Neosho madtom should be clarified by noting this species occurs on the Federal and State lists of endangered or threatened species.

5 Page 4, Natural Resources Changed or Lost--This section indicates there would be no loss of wooded floodplain, yet in the "impacts" segment in the preceding paragraph, 35 acres of forestland would be eliminated. This illustration either needs narrative clarification or the reference to wooded floodplain should be eliminated.

6 Fisheries--This section notes those species that may be benefited by the project. It also should note that while lacustrine fish fauna may be benefited, stream dependent species such as spotted bass, log perch, madtoms, longear sunfish, and others may be adversely affected. Slow, constant flows and lack of peak flows create conditions that favor lacustrine fishes and place obligate stream dwellers at a disadvantage.

7 Page 25, Fish and Wildlife, paragraph 2--See comment for page 1.

8 Page 31, Stream Ecosystems--The impression given is that all streams within the watershed are extremely degraded. This needs to be corrected in the final document. The stream evaluation conducted by the FWS, Soil Conservation Service, and Kansas Department of Wildlife and Parks the week of July 16, 1990, indicated the stream segments affected by sites 101 and 102 had a strong spring flow, were clear, and had a diversity of aquatic biota. Although affected by agricultural encroachment with its associated nonpoint source pollution and some siltation, the problems were not considered excessive.

9 Page 63--The Environmental Impact Statement should not say there will be no impact on the threatened and endangered species; rather, it should state that a "no jeopardy" opinion has been issued, which specifies that a monitoring study in the South Fork watershed must be completed prior to construction in Doyle Creek.

10 Page 68, Fish and Wildlife Impacts, paragraph 3--Installation of P.L. 566 dams will not partially offset the demand for stream fishing. The document should state that stream fishing demand will remain constant, but the amount of natural stream habitat within the watershed will be reduced.

11 Page 69--The paragraph below table V states there shall be no adverse impact on any threatened or endangered species. Formal consultation on the Neosho madtom is referenced with regard to the South Fork, Doyle Creek, Diamond Creek, and Middle Creek watersheds. The FWS's biological opinion is cited, indicating a "no jeopardy" opinion contingent upon a monitoring study to be

implemented in the South Fork. This statement is true to the extent that it realizes the construction limitations imposed by the opinion.

Specifically, the following reasonable and prudent measure was offered in the biological opinion as necessary to minimize incidental take of Neosho madtom:

> "No watershed construction within Diamond Creek, Middle Creek, Doyle Creek, or elsewhere in the Neosho River Basin shall begin until results are gained from the South Fork Study program. This study shall require a minimum of one year baseline field observation prior to final closure of any more dams, and shall continue for a minimum of two years following completion of the last project in the South Fork watershed."

11

Therefore, the Environmental Impact Statement should note that compliance with the terms of the biological opinion will preclude any construction which will impound natural streamflow, including flood flows, in any watershed tributary to the Neosho River until the South Fork monitoring study is completed. At that time, the Fish and Wildlife Service and the Soil Conservation Service will have a better idea of the impacts, if any, of watershed development on the Neosho madtom.

Thank you for the opportunity to review the subject document. If you have any questions regarding these comments, please contact William Gill, Kansas State Supervisor, Manhattan, Kansas, at (913) 539-3474.

Sincerely,

Jonathan P. Deason
Director
Office of Environmental Affairs

Response

1 A majority of this watershed is cropland.

2 See response to comment number 11.

3 Correspondence from the Fish and Wildlife Service dated December 14 and 18, 1989 shows that the western prairie fringed orchid does not exist in the watershed. Reference to this species has been deleted.

4 A clarification has been added to show both federal and state listing of the Neosho madtom.

5 The reference to wooded flood plain has been deleted as suggested. The proposed forestland treatment plan includes planting about 200 acres to trees along the stream channel as riparian buffer strips.

6 The paragraph has been revised to read "Spotted bass, log perch, and longear sunfish, that do not provide a sport fishery, may be affected in the permanent pool areas where these populations presently exist."

7 Revision made as suggested.

8 Paragraph modified for clarification.

9 See response to comment number 11.

10 The watershed has an estimated 60 miles of perennial stream. Kansas Wildlife and Parks estimates that fishing is limited to 17 miles from the mouth of Doyle Creek to Peabody. Their October 1976 Preliminary Stream Survey concluded that catchable fish were in pools above Peabody but that the stream's use was insignificant. The dams will not eliminate any stream sections being utilized for fishing. As the quality of stream water improves, the demand for stream fishing will increase.

11 This paragraph has been revised to state SCS's biological assessment conclusion that the project will have no adverse impact on the madtom. Also a revision has been made to clarify the Fish and Wildlife Service's biological opinion. SCS by letters dated July 15 and November 22, 1991, to Bill Gill, Fish and Wildlife Service, stated that SCS plans to proceed with construction as scheduled for projects within the Cottonwood Basin unless the monitoring study indicates this action would be inappropriate.

DEPARTMENT OF THE ARMY
TULSA DISTRICT, CORPS OF ENGINEERS
POST OFFICE BOX 61
TULSA, OKLAHOMA 74121-0061

REPLY TO ATTENTION OF

NOV 25 1991

Planning Division
Environmental Analysis and Support Branch

Mr. James N. Habiger
State Conservationist
760 South Broadway
Salina, KS 67401

Dear Mr. Habiger:

This is in response to the draft Watershed Plan/Environmental Impact Statement for Doyle Creek Watershed, Harvey and Marion Counties, Kansas.

Although the site is within Tulsa District's Civil Works boundary, jurisdiction under Section 10 of the River and Harbor Act of 1899 and Section 404 of the Clean Water Act for projects on private property in Kansas has been delegated to the Kansas City District. A copy of your letter was sent to Mr. Joseph Hughes, Chief Regulatory Section, U.S. Army Corps of Engineers, 700 Federal Building, 601 East 12th Street, Kansas City, MO 64106-2896. Their telephone number is (816) 426-5047.

The Tulsa District's review comments are enclosed.

Thank you for the opportunity to comment on this proposed project.

Sincerely,

G. David Steele
G. David Steele, P.E.
Chief, Planning Division

Enclosure

Tulsa District
Review Comments Doyle Creek Watershed

1. Page 14. Tables C and D should incorporate damages and benefits of the respective plans considered for construction within the reach computations.

2. Page 14, last paragraph. John Redmond Reservoir was designed to contain 55,000 acre-feet of sediment. As presented in the design report this volume of sediment was based on Marion, Council Grove and Cedar Point Lakes being constructed. Cedar Point was not constructed which caused a moderate increase in sediment delivered to and trapped by John Redmond Reservoir. The second resurvey of sediment deposition in John Redmond Reservoir was performed in September 1983 and the average annual sediment deposition was 1,094 acre-feet per year. This annual rate of sediment deposition is below the design annual rate.

3. Page 15, first paragraph. The 51,000 acre-feet figure should be 55,000 acre-feet.

4. Page 30, Table K. The total projected future sediment deposition presented in Table K is 60 acre-feet per year. The total drainage area involved in the proposed sites including the ponding area is 34.33 square miles. When the drainage area is reduced by the area of the spillway crest the net sediment contributing drainage area becomes 32.96 square miles. As presented in the table the sediment becomes 2.063 acre-feet per square mile per year. The measured amount for the net sediment contributing area for John Redmond Reservoir is 0.434 acre-feet per square mile per year.

Site No.	D.A. (sq. mi)	Area at Spillway Crest (AC)	Net Sediment Contributing Area (mi)
5	4.16	162	3.91
6	2.95	111	2.78
10	3.02	105	2.86
11	1.60	63	1.50
101	15.80	328	15.29
102	6.80	115	6.62
	34.33	884	32.96

If the 33 percent determined in the above sites is added, the total sediment delivered to John Redmond Reservoir (no projects as above in place) then this small D.A. supplies an additional 33.5 acre-feet making a total of 101.5 acre-feet per year. The measured amount as presented on the 1707 is 1094 acre-feet per year. Thus sediment generated from this 34.33 square mile area

is just under one-tenth the total delivered to John Redmond. The total sediment contributing drainage area is 2519 square miles. It appears unrealistic to predict that 10 percent of the sediment load comes from 1.4 percent of the total contributing area.

5. Page 36, Table M. Reduce sediment yield. Reference previous two comments.

6. Page 42, Table P, first heading under Future Without Project. Should be revised to read: Continue on-going land treatment program including CRP and 1985 Food Security Act.

7. Page 44, Second paragraph. This paragraph should be revised to reflect the information furnished in comments 3 and 4.

8. Page 59, Table 3, site 5. The drainage area for site 5, as shown on project map, is 4.16 square miles not 4.46 as shown in the table.

9. Page 59, Table 3. The combined releases from the 6 lakes would be about 550 cubic feet per second (c.f.s.) extending over a period of several days. The operational channel capacity on the Cottonwood River in this vicinity is about 8,000 c.f.s.. Releases from the Doyle Creek Watershed would be using about 7 percent of the operational channel capacity and could cause delays in evacuation of flood control storage from Marion Lake. While this reduction is small the possible development of several watersheds within the Cottonwood River basin could have a significant effect on the flood control operation of Marion Lake.

A similar comment was made in our letter of March 26, 1984, to Mr. John W. Tippie, State Conservationist, as a result of our review of the South Fork Watershed. The South Fork Watershed projects had a combined release of 1000 c.f.s.. The combined effect of releases from all the watershed projects should be evaluated and the negative effect on benefits provided by Marion Lake should be included in the economic and environmental analysis.

10. Page 66, Table T. This table should be revised in accordance with previous comment 4.

11. Page 66, last paragraph. On page 48, paragraph 3 the total sediment storage for Doyle Creek is stated to be 1601 acre feet for the six proposed structures. In the last sentence on page 66 the report states "about 28 percent of the 6,705 acre-feet is from Doyle Creek", which computes to 1,877 acre feet. This appears inconsistent with previous statements. The life extension of John Redmond with six structures for Doyle Creek basin would be just under 2 years using the figures presented. The values shown in this paragraph are not of sufficient detail to prove a 13 year life extension for John Redmond. Suggest deleting this paragraph or substantiate with more detail.

Response

1 Tables C and D show physical conditions within the watershed and are not intended to show beneficial effects.

2 The 51,800 acre feet of sediment storage was an estimate released to the State of Kansas in 1983. At that time information was being developed for the Kansas Water Office reservoir sediment storage study. A sediment survey was done to measure the sediment accumulation in John Redmond Reservoir which was 21,871 acre feet for the 19 years that the lake has been in operation. This represents a rate of 1,151 acre feet per year. Total sediment storage would last 47.8 years for 55,000 acre feet and 45 years for 51,800 acre feet at the above rate. In either case the rate is greater than the design rate.

3 Change made as suggested.

4 Table K, page 30, shows watershed conditions in the future without any project action. This alternative includes all future land treatment and state-funded structures to be built through the on-going program. It does not include any of the PL-566 dams.

The drainage area shown in Table 3 for Dam No. 5 of 4.46 square miles is correct. The project map will be revised to agree.

The PL-566 structures when built will store approximately 16 acre feet of sediment per year or 0.485 acre feet/square mile/year. For the entire Doyle Creek Watershed, the sediment yield is 0.487 acre feet/square mile/year which is very similar to the Corps' measured 0.434 acre feet/square mile/year.

Doyle Creek will capture a disproportionate share of sediment due to a higher percentage of cropland within the watershed as compared to other watersheds in the basin. The percent of cropland becomes less with an increasing proportion of grassland as you move east from Doyle Creek to John Redmond.

The area controlled by PL-566 structures is approximately 1.31 percent of the drainage area to John Redmond. At 16 acre feet/year sediment storage this represents 1.46 percent of the sediment entering John Redmond. This is a consistent relationship.

5 See response to comment 4 above.

6 Revised as suggested.

7 See response to comment 4 above.

12. Page 69, Water Quality, second paragraph. The 23,100 tons per year figure (52%) is inconsistent with previous values presented in the report.

13. Appendix B, map B-2. Suggest deleting this map and replacing with the project map at end of report.

8 The drainage area of Dam No. 5 is 4.46 square miles as shown in Table 3 of the plan. The drainage area on the project map will be corrected.

9 Corps of Engineers' Marion Lake operations were used in modelling the basin. Watershed project release rates were reviewed and coordinated with personnel from the Corps of Engineers Tulsa District. In a letter to Bethel Herrold, Planner, dated October 10, 1980, an explanation was given of the release rates from potential P.L. 566 dams for several watersheds. Further explanation of modelling results was explained in a letter to Ralph Hight dated December 12, 1980. Releases from P.L. 566 dams were added to Marion Lake releases without apparent detriment.

10 See response to comment 4 above.

11 The 1,601 acre feet of sediment storage only accounts for the storage in the PL-566 flood control structures. Sediment other than from these areas controlled will be captured by conservation practices including terraces as well as state-funded structures. The total capture from all structures will be approximately 28 percent.

The 13 year life extension accounts for all PL-566 projects within the river basin.

12 There is a difference in sediment yield to the mouth of the watershed and that which is yielded to John Redmond. The 9,100 tons difference is that amount which is deposited between the watershed mouth and John Redmond Reservoir.

13 The basin map serves an important function in showing the relationship of Doyle Creek to Marion Lake and John Redmond Reservoir as well as other P.L. 566 watersheds.

KSU
KANSAS STATE UNIVERSITY

Dean of Agriculture

Waters Hall
Manhattan, Kansas 66506-4008
913-532-6147
FAX: 913-532-6563

December 2, 1991

Margaret Fast
Kansas Water Office
109 S.W. 9th Street, Suite 300
Topeka, KS 66612-1249

Dear Margaret:

Thank you for the opportunity to review the Watershed Plan and Environmental Impact Statement for the Doyle Creek Watershed.

The Watershed Plan provides for construction of six floodwater retaining dams, forestland treatment, mitigation for wildlife habitat, and local responsibility for the operation, maintenance, and replacement of the works of improvement. The plan was formulated in cooperation with the Watershed Board and the Soil Conservation Service with invited public participation and the cooperation of numerous state and federal agencies.

We believe that implementation of the Watershed Plan will reduce flooding and enhance the quality of the water both in and beyond the boundaries of the Doyle Creek Watershed.

Should there be need to consult about questions of erosion control, crop production, water quality, or non-point source pollution, the Kansas Agricultural Experiment Station would be pleased to consult with the project sponsors.

Sincerely,

Hyde S. Jacobs
Assistant to the Dean

cc: Walter R. Woods

No response necessary

KANSAS STATE HISTORICAL SOCIETY

HISTORIC PRESERVATION DEPARTMENT
Center for Historical Research
120 West Tenth * Topeka, Kansas 66612-1291
913-296-7080 * FAX 913-296-1005

October 2, 1991

Margaret Fast
Kansas Water Office
109 SW Ninth, Suite 300
Topeka, Kansas 66612-1249

Re: Doyle Creek Watershed
Watershed Plan/Environmental
Impact Statement

Dear Ms. Fast:

The Doyle Creek Watershed Plan/Environmental Impact Statement adequately addresses the concerns of this office for the identification and preservation of historical and archeological sites. The Soil Conservation Service (SCS) has complied or will comply with federal laws and regulations concerning cultural resources.

Sincerely yours,

Ramon Powers
State Historic Preservation Officer

Richard Pankratz, Director
Historic Preservation Department

RP/ms

No response necessary

STATE OF KANSAS

Joan Finney, Governor

KANSAS WATER OFFICE
Stephen A. Hurst
Director

Suite 300
109 SW Ninth
Topeka, Kansas 66612-1249

913-296-3185

November 27, 1991

James N. Habiger
State Conservationist
U.S. Department of Agriculture
Soil Conservation Service
760 S. Broadway
Salina, KS 67401

Dear Mr. Habiger:

The interagency review draft Watershed Plan and Environmental Impact Statement for Doyle Creek Watershed was distributed by this office. Comments were received from the Kansas Biological Survey, the Kansas Department of Health and Environment, the Kansas Department of Wildlife and Parks, the Kansas Geological Survey and the Kansas State Historical Society. Their respective comments are attached.

1 Kansas Department of Health and Environment indicates concern about the delineation of wetlands, the value of benefits for water quality and the inclusion of treatment of livestock feeding areas. Kansas Department of Wildlife and Parks includes several specific comments. The Kansas Water Office would suggest that the "Problem Identification" section on page two include a paragraph on water quality impairment beyond that implied in the discussion of riparian timber. A suggestion is to include some of the discussion from page 15, i.e., "Non-point source (NPS) pollutants impair watershed streams use for aquatic life and contact and non-contact recreation."

There is a general concern expressed by the Kansas Department of Wildlife and Parks, Kansas Geological Survey and Kansas Biological Survey relating to a larger, philosophical question that is, perhaps, beyond the scope of an individual watershed plan. This is the fact that the protection of a stream ecosystem as a valuable goal goes beyond dollar value and angler days. It is recognized that an emphasis on economics is a reality. The Kansas Water Office has requested money to finance research on the impact of watershed structures. Again, this general issue is not one that can or should be addressed in a watershed plan but as the Kansas Geological Survey's letter states, "local, state and federal agencies should make a greater effort to assess the overall effect of soil and water conservation techniques on the state water budget" and, indeed, on the natural resources of the state.

Thank you for the opportunity to comment.

Sincerely,

Stephen A. Hurst
Director

SAH:MAF:dk
Enclosures

Response

1 Problem identification on page 2 has been expanded to include non-point source pollutant impairment as suggested.

State of Kansas
Joan Finney, *Governor*

Department of Health and Environment
Azzie Young, Ph.D., *Secretary*

Reply to: 913-296-0077

November 13, 1991

Mr. Steve Hurst, Director
Kansas Water Office
109 SW 9th
Topeka, KS 66612

Dear Steve,

Please find attached the Kansas Department of Health and Environment's review of the Doyle Creek Watershed Plan and Environmental Impact Statement.

During the review, it was noted that inconsistency between state laws and federal laws may exist. A review and possible revision of state watershed laws should be considered to include water quality. This is discussed further in the attached comments.

In addition to the formal comments, the Clean Water Act as Amended by the Water Quality Act of 1987, Section 319(k), requires consistency with the state nonpoint source management plan. The EIS should note how activities associated with this project will address nonpoint source pollution concerns as identified in the state management plan.

Thank you for the opportunity to review the Doyle Creek Watershed Plan and Environmental Impact Statement.

If you have any questions, please contact Ron Fox on my staff, telephone number 296-0077.

Sincerely,

Azzie Young, Ph.D.
Secretary

AY:RF/kjt

Forbes Field • Building 740 • Topeka, Kansas 66620-0001 • (913) 296-1500

Review of Doyle Creek Watershed Plan
and Environmental Impact Statement

1 Wetlands appear to have been discounted as a concern and grouped within the grassland category.

2 Although the individual wetlands may be small isolated pockets, the cumulative impact of several of these may have positive impact on the water quality in the watershed. Delineation of location and area should be done.

3 The Watershed Protection and Flood Prevention Act of 1954 as amended (16 USC 1003a) allows for cost share assistance to project sponsors which enables such sponsors to acquire perpetual wetland or flood plain conservation easements to perpetuate, restore and enhance the natural capability of wetlands and flood plains to retain excessive flood waters, improve water quality and quantity, provide habitats for fish and wildlife. Perpetual wetland and flood plain easements should be pursued for the upper reaches of all proposed watershed structures to ensure those wetlands lost are replaced and will remain as such.

4 During the discussion of "Formulation of Alternatives," the issue of water quality is discussed. Although water quality may not be a primary goal of watershed districts, it should be given greater weight in this EIS. Section 3(G) of 16 USCS 1003 was amended requiring conservation plans having measures needed to enhance water quality of lands within the area. Summaries or some details of plans needed to address water quality should be included in the EIS.

5 The summary and comparison of candidate plans fails to consider the possibility of other configurations which may achieve the goals of NED plan and Water Quality Plan.

6 Significant water quality impairment by livestock confined feeding areas is identified in the water quality section. However, the NED plan does not address these sources. The inclusion of treatment of the 52 facilities should be added to the NED.

7 It is inconsistent to include livestock feeding areas treatment in the Alternative 3, water quality plan, with zero benefit and not include the same in Alternative 2. The water quality benefits are given a zero value for benefits in Kansas. Is this done in all states or is Kansas unique?

8 What do the other states do? If it is nation wide, USDA needs to resolve the beneficial value aspect of water quality.

9	The Comparison of the Candidate Plans section is only a token comparison. This section states the NED Plan, Alternative 2 is the most efficient flood control plan. This will reduce flood damages by 31%. Alternative 3 would reduce flood damages by 42%. The comparison section does not validate the statement that the NED Plan, Alternative 2 is the most efficient flood control plan. Even the EIS on page 46 states the water quality plan could achieve more flood control.
10	The EIS does not adequately address the benefits for water quality. The economic modeling is inadequate to arrive at a conclusion in favor of either alternative.

Response

1 Our statistical data base did not identify any wetlands in the sample, but small areas were observed during field surveys. Two acres of wetlands were identified at one dam during the wildlife habitat evaluation.

2 This project affects two acres of wetlands which is insignificant. The loss will be more than offset by the creation of wetland at the six reservoirs built with the project.

3 The water retained in the sediment pools will create at least 12 acres of wetlands that more than offsets the loss. Perpetual easements are not required since wetlands will occur naturally.

4 Alternative 3 describes treatment practices and measures to comply with the water quality standards. See the Preliminary Water Quality Assessment 1990 prepared by Vic Robbins of NDHE.

5 The summary and comparison of candidate plans considered known viable alternatives.

6 The National Economic Development plan requires benefits to exceed costs. A narrative description of treating confined livestock feeding areas is not acceptable to measure against treatment costs; hence, treatment of confined livestock feeding areas is not eligible for inclusion in the National Economic Development plan.

7 See response 6.

8 Evaluation procedures have not been developed to show dollar benefits to livestock confined feeding operation treatment. We would be happy to include any beneficial effects that are identified.

9 The comparison of plans is intended to be brief touching on major issues on which each alternative has some affect. The investigation and analysis section, page 7, shows that 12 alternatives were evaluated to determine the National Economic Development plan. The National Economic Development plan is based on efficiency which is measured in terms of net benefits and not in terms of total damage reduction benefits.

10 By definition the National Economic Development Plan is the most efficient plan formulated, but it does not necessarily meet the water quality standards. The water quality plan focuses on treatment and may be less efficient; however, it meets the state's water quality standards. See explanations shown in response nos. 6 and 8. Evaluation procedures have not been developed to measure all of the water quality benefits in monetary terms.

OPERATIONS OFFICE
RR 2, BOX 54A
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(316) 672-5911
Equal Opportunity Employer

DEPARTMENT OF WILDLIFE AND PARKS
JOAN FINNEY, Governor
JACK LACEY, Secretary
JOHN S. C. HERRON, Assistant Secretary

November 14, 1991

Stephen A. Hurst
Kansas Water Office
Suite 300
109 SW Ninth
Topeka, KS 66612-1249

Ref:D1.0402
Doyle Crk WSD #86

Dear Mr. Hurst:

This will respond to your October 1, 1991 letter to several offices of this agency requesting comments on the draft Watershed Plan/Environmental Impact Statement for Doyle Creek Watershed. All such direct coordination and consultation with the various watershed districts is handled through this agency's Environmental Services Section. In light of this Section's responsibility, I have been directed to provide our agency's comments on the draft plan. The comments provided are, however, the result of reviews by both field and Section personnel. The comments are directed to the designated sections, paragraphs, and/or lines within the draft document.

Page i, Abstract: Wording in Paragraph One is erroneous regarding environmental impacts. In line 9, the word "slight" should be deleted. No other impacts 1 listed have such a qualifier. There will be an irreversible and irretrievable loss of stream aquatic habitat at all structures. Two of the sites (101 and 102) have perennial stream flows and support a diverse aquatic wildlife community.

The words "increased wildlife habitat quality" should be deleted unless it 2 can be supported. The project narrative does not include any measures to specifically enhance wildlife habitat. Table II in Appendix C documents a net loss of wildlife habitat value with the project.

Increased water quality with the project will depend on land use. If landusers are allowed to provide unrestricted livestock access to impoundments and remaining stream channels, water quality will continue to 3 be impaired. Further agricultural encroachment upon riparian areas along stream channels will also continue to damage water quality. In our opinion, installation of flood dams and land treatment above them without improving land use elsewhere in the District will not succeed in improving water quality.

Page 2, Para. 2: Neosho madtoms occur in both the Cottonwood and Neosho rivers 4 which are affected by runoff from Doyle Creek watershed. The last sentence should be changed to read "...invertebrate populations which provide food for Neosho Madtoms."

Page 3, Para. 1: While "over-mature" woodlands may "lack vigor," such old growth with an abundance of snags, standing dead, and den trees is extremely 5 valuable to woodland dependent wildlife. It was our observation that abusive grazing practices in riparian woodlands were contributing to poor nutrient control more significantly than over-maturity of the tree stands.

Page 3, Para. 2: Correct typo "incre-mental" in line 3.
Line 4-5: Should say which set of Water Quality Standards (date of 6 publication or as of some date of writing or publication). The Kansas Water Quality Standards are overdue for revision and the unpublished draft standards are much stricter than current ones. They may be in effect by the time this draft is published as a final.

Page 3, Para. 3, Line 2: Add "improved" to "... "and ____ water quality." 7

Page 4, Natural Resources Changed or Lost: There very likely will be a loss in acres of wooded floodplain. The mitigation proposal calls for replacement 8 of woodland wildlife habitat value, not woodland acres. Table II, Appendix C states woodland compensation will be a combination of planting and preservation. This method will definitely result in a net loss of woodland acres.

Regarding Fisheries, we disagree with labeling stream reaches to be inundated as intermittent. Sites 101 and 102 were obviously perennial 9 streams based on physical and chemical habitat characteristics and their aquatic community structure. Site 6 was fed by spring seeps flowing through gypsum outcroppings. There will be a loss due to inundation of some perennial streams without compensation. Stream fishing may decline because of reduced stream habitat.

Flathead catfish are likely to decline, not increase. Flathead catfish are primarily riverine fish that migrate long distances upstream for spawning 10 runs. The Doyle Creek Watershed structures, both federal and state, will obstruct fish passage in the drainage and will deny some flathead catfish access to traditional spawning areas. Flathead catfish are long-lived and should persist in the reservoirs, but not as a self-sustaining, natural population.

The general objection to watershed plans applies to this plan and EIS; that is, the stream ecosystem as a valuable entity to aquatic and terrestrial wildlife as well as humans is ignored. Only the fisheries values are addressed. What about biological diversity, nongame fishes, the aesthetic 11 value of a clean, flowing river, other non-consumptive recreational values, the water filtering and conveyance properties of a steam, terrestrial wildlife values, and many others? We agree the fishery value is important and is quantifiable, but greatly underestimates the value of a functioning stream community when it is the only value addressed.

Page 11-12, Floodwater Damage:

Para. 1, cropland benefits ($131,000/year flood damage)

12 The watershed project appears to be trying to protect the number of acres in production instead of being in tune with other USDA programs such as CRP, Wetland Reserve, and others that set-aside land that is highly erodible and actually reduce the number of cropland acres. Some of the farmland in question may be poorly sited in the floodplain or in some cases have encroached into the floodway. Instead of using public funds to protect past mistakes and destroy stream ecosystems, where feasible the funds should be used to correct mistakes and restore stream systems

Para. 2, livestock facilities and fencing ($64,900/year flood damage):

13 As the above paragraph mentions, fences and hog pens sited poorly in the floodplain and floodway places them at risk, and in the case of livestock, endangering the state's waters by degrading quality. Relocation would seem practical.

Para. 3, roadways and bridges ($4,200/year flood damage):

14 Viable alternatives that are ecologically less damaging to stream and terrestrial ecosystems may call for longer bridges, fewer bridges and roads, and correcting poorly designed or sited transportation links. As in many rural areas in Kansas and the Midwest, there are less and less people living on bigger and bigger farms and small towns are declining everywhere. A project designed to benefit 1000's of people in the 1940's or 1950's needs to be evaluated in terms of the 1990's and beyond and truly balance the public interest of protecting Kansas' streams and waters with the private property of a declining populace.

Para 4, railroads ($9,700/year):

15 Many railroads beds in Kansas act as man-made levees, often accentuating flooding problems. Problem areas should be delineated and the alternative of modifying the railroad grade, possibly with the addition of culverts and new bridges. What if the railroad is abandoned? One would think that flood problems created by railroad beds might disappear with the removal of the line.

Page 12, Para. 3, Line 1-2, grain elevators, fertilizer storage tanks, fertilizer warehouses:

16 While we know it will help downstream river reaches to keep these sources of pollution from reaching Kansas waters, it would be more prudent to use public funds to help relocate such private, poorly sited businesses out of the floodplain than to destroy free-flowing streams and riparian corridors that provide many natural resource benefits. An alternative that provides an overflow channel that protects Peabody from floods may be feasible. The overflow channel would have to be sited in a ecologically benign manner, perhaps through existing crop fields or other disturbed areas.

Response

1 Abstract - "slight" deleted as suggested.

2 The increased wildlife habitat quality is associated with the forestland treatment program. The reference is revised to tie effect to this program.

3 Sediment is one of the water quality parameters. The dams will reduce sediment entering Doyle Creek hence water quality will be improved.

4 Correction made as suggested.

5 Grazing practices have been added.

6 Typing error has been corrected. A reference to the Preliminary Water Quality Report 1990 by Vic Robbins has been added.

7 Correction made as suggested.

8 Wooded flood plain has been deleted as recommended by the USDI.

9 The dam site wildlife habitat survey verified perennial streams at Dam Nos. 101 and 102. The preliminary classification has been revised as suggested to show length of perennial streams for these dams.

10 Flathead catfish have been deleted from the listing.

11 Only recreation associated with angler days of fishing is shown because no one is willing to put a dollar value to other values. We agree other non-quantified benefits occur and have added them as suggested.

12 This comment raises apparent conflicts between cropland reduction goals of the Conservation and Wetland Reserve Programs and cropland protection benefits available through P.L. 566. Congress passed laws making these programs available. The project sponsors have a right to apply for and receive benefits available through the Public Law 566 watershed program. This project has been formulated to meet P.L. 566 program requirements and other federal and state water policy. The SCS cannot arbitrarily deny benefits available through any one of the programs to satisfy philosophical concerns.

13 See response 12.

Page 15, Water Quality: Non-point pollution problems do exist in the Doyle Creek Watershed as well as many other of Kansas' stream basins. Under NEPA, all alternatives should be given serious consideration including non-structural plans and changes in land use practices. By using the pollution problems to justify the destruction of existing riparian woodlands (Sites 101 and 102) and wetland (Site 6) that filter pollutants, the Doyle Creek Watershed Plan reaches its lowest point. No mention of the water quality of the reservoirs, both State and Federal structures, is given. They will act as nutrient sinks and will likely present water quality, fishery, and water supply management problems. What about designing and operating structures that function as artificial wetlands with their great
17 biofiltering capacities? The use of structures for watering livestock can increase the concentration nutrients resulting in a net increase in pollution loading. Unprotected reaches downstream of structures may have increased pollution input to the remaining stream ecosystems because of a misconception of total flood protection which can encourage cropland encroachment upon stream channels and loss of riparian filterstrips. The net result due to such secondary impacts on downstream land-uses may result in no net change or even an increase in water quality problems. The loss of dilution due to increased water storage and evaporation, may also result in water quality declines. This could be expensive for the small cities of Peabody and Florence if the new State Water Quality Standards are approved and they need to make very expensive upgrades to their sewage systems.

Another problem with declining water quality and quantity will be the cumulative impacts on the Neosho madtom and its designated critical habitats in the Cottonwood and Neosho mainstems. The new water quality standards will impose "No degradation" standards on these protected waters.

18 Page 25, Fish and Wildlife:
Line 3, Change "Cyprinoids" to Cyprinids."

19 Line 15, Delete "gray squirrel" as it does not occur in Doyle Creek Watershed.

20 Line 17, "Yellow-shafted Flicker" should be "Northern Flicker."

Page 49 -Mitigation Features: In the first paragraph the term "critical habitat" is used twice. In both state and federal regulatory terminology, the
21 adjective "critical" is reserved for use in association with habitats for threatened or endangered species. Since the Doyle Creek project currently has no mitigation for T/E species, use the adjective "crucial."

Sincerely,

Robert D. Wood

Robert D. Wood, Wildlife Ecologist
Environmental Services Section

RDW:bk
xc: USFWS, Manhattan
Reg. 4, Sorensen
SCS, Kuiper

14 The non-structural plan cited in the plan considered closing selected roads and moving the major roads off the flood plain. It was not cost effective to do this. See also response 12.

15 See response 14

16 The flood damage evaluation procedure includes a projection of future conditions without project action. The damages are low and an overflow channel to protect Peabody is not feasible.

17 The project is not justified on the basis of water quality benefits. Water quality effects are incidental to the primary purpose of flood control. See disposition of USDI's comments regarding T&E species.

18 Spelling changed as suggested.

19 "Gray squirrel" deleted as suggested.

20 Revised "Yellow-shafted Flicker" to "Northern Flicker" as suggested.

21 Revised "critical" to "crucial" as suggested.

The University of Kansas

Kansas Biological Survey

14 November 1991

Margaret Fast
Kansas Water Office
109 SW Ninth, Suite 300
Topeka, Kansas 66612-1249

Dear Ms. Fast,

Thank you for the opportunity to review and comment on the Doyle Creek Watershed Interagency Review Plan Draft of the Watershed Plan and Environmental Impact Statement.

The interagency effort is to be commended and represents what we feel is a good model for similar planning activities in the future. The document is well written, relatively comprehensive, appears to meet the stated goals and objectives, and points to a slow evolution toward a more balanced environmental approach in watershed planning efforts.

Even though advances have been made, there is still evidence that a "true" environmental balance in planning has not yet been attained. Realistically, the balance probably will not be achieved until our society changes its prevailing attitude. We still seem to emphasize economics over trying to preserve or regain an equilibrium with our environment. For example, in the Plan the primary problem is identified as floodwater damage which, by the way, is calculated on a dollar basis. However, floodwater damage (in a clinical sense) is, in our view, only a symptom of the larger problem that could be more correctly identified as: land use management and practices over the past few decades has resulted in an increase in floodwater damages within the watershed. Another example is the Watershed District's rejection of Water Quality Plan Alternative because of cost. A third example is the stream ecosystem evaluation that emphasized sport fisheries as opposed to species diversity in general. Also, potential aquatic system improvements were more often than not equated with an increase in angler days and fishing opportunities. It may be easier to derive a dollar value for angler days and a stream with a healthy game fish population is usually fairly healthy in other respects as well, but the primary intent should be to improve the aquatic system's overall biodiversity.

2041 Constant Ave. • Lawrence, Kansas 66047-2906 • (913) 864-7725

The above comments are not intended to reflect negatively on the plan, but, rather, are food for thought in future watershed planning efforts. We find the Doyle Creek Plan generally acceptable and, indeed, this is the first watershed plan we have seen to even contain a Water Quality Alternative as well as the kind and degree of mitigation measures to be employed. Again, the cooperation and interaction between all involved in the planning process is noteworthy. We would expect that as National and State farm policies continue to change and environmental awareness keeps growing, it will be most readily reflected and implemented through a multi-disciplinary, interagency watershed planning effort such as this.

Again, thank you for the opportunity comment on the Plan.

Sincerely,

Paul M. Liechti

Paul M. Liechti
Assistant Director

No response necessary

KANSAS GEOLOGICAL SURVEY
Office of the Director

1930 Constant Ave., Campus West
The University of Kansas
Lawrence, Kansas 66047
913-864-3965

November 5, 1991

Ms. Margaret Fast
Kansas Water Office
Suite 300
109 SW Ninth
Topeka, KS 66612-1249

Dear Margaret,

I've just finished reviewing the Doyle Creek Watershed Plan and it seems to include areas we would be concerned with. There is little groundwater impact to be concerned with since the basin doesn't overlie one of the state's major aquifers.

One of the areas of concern is that of the change in flow regime caused by taking the peaks off the flood events and the long term effects on channel morphology and natural recharge. Changes in flow regime seem to have been treated adequately in this study by making estimates of the changes in discharge. These issues are more critical in areas of the state where there is an alluvial aquifer involved and precipitation is less (Walnut Creek for example).

In the larger picture, however, KGS has had several inquiries regarding the effects of watershed structures on channel morphology and gravel bar movement in streams in eastern Kansas. We have no data or studies on this issue which will effect some species of wildlife that depend on the habitat in their particular stream. Watershed structures, farm ponds, terracing, and the myriad other water and soil conservation techniques work and work well for the use intended. However, these methods are reviewed and their effects are assessed on a project by project basis but I'm not sure anyone is looking at the cumulative effect on the bigger picture of the hydrologic cycle in Kansas. My concern is that we're looking at the individual trees and not paying enough attention to the long term effect on the health of the forest.

This issue is not one that can or should be addressed in a watershed plan, but local, state and federal agencies should make a greater effort to assess the overall effect of soil and water conservation techniques on the state's water budget.

Thanks for the opportunity to comment.

Sincerely,

Tom McClain

Tom McClain
Associate Section Chief
Geohydrology Section

No response necessary

Kansas Chapter

THE WILDLIFE SOCIETY

P.O. Box 331
Mound City, KS 66056
Nov. 26, 1991

Mr. James Habiger
State Conservationist, SCS
760 Broadway
Salina, KS 67401

Dear Mr. Habiger:

The Kansas Chapter of The Wildlife Society (KSCTWS), a state chapter of the national professional society of wildlife biologists, appreciates the opportunity to comment on the Watershed Plan and Environmental Impact Statement for the Doyle Creek Watershed. Major observations regarding the rationale for such a program are as follows:

1. a) Throughout the years, observation of watershed districts leads to the conclusion that their recommended solution to nearly any problem is the construction of dams. These are extremely costly programs and tend to treat symptoms instead of problems. Even though the Doyle Creek Watershed Board agreed to some (filter strip) reforestation, their focus is obviously still on dam building to "control flooding".

b) The bulk of "flood damages" is on agricultural land, primarily cropland. We question the federal (or state) government's role in providing additional tax dollars to protect a very small percentage of farm land from what is and always has been a natural occurrence (flooding). The fact is, that occasional flooding is what has created the most fertile farm lands in the stream valley. Landowners recognize this and accept some limitations from flooding in exchange for excellent crops produced in most years from these lands.

c) Reduction in sediment is an admirable goal but treating the problem is more likely to prevent excessive sediment loads rather than just trapping some behind a dam. Farmers could use some additional federal (and state) tax dollars to increase the use of filter strips, contour grass strips and the seeding of erosion prone fields to native grasses. These practices combined

1

with good farming practices would do more to reduce sediment loading than dam construction. Wildlife benefits would certainly be greater from these techniques.

2. a) The general public (taxpayers) will benefit more from a cleaner stream with natural high and low flows than from a series of dams on private land.

b) The effects of these dams locally has never really been explored. What about retention of runoff from very localized rains during critical dry times which normally would help recharge the upper reaches of the stream? Related to this would be catching of natural spring flows which may have helped aquatic life survive during drought.

c) The plan hints that wildlife and aquatic habitat below these dams would be enhanced. It is more likely that, if dams really do decrease flooding, that the land use will intensify with increased cropping and grazing in the flood plain. Typically this activity is associated with additional wildlife habitat losses. Indeed, the plan (pg. 63) indicates that, an additional 445 acres of prime farmland will result. Undoubtedly this will be at the expense of wildlife habitat. Taxpayers should question a program which increases cropland during a time when we have paid millions of dollars to take nearly 3 million acres out of production in Kansas (CRP). Additional cropland will actually burden the public with **more** crop subsidy payments.

3. Specific comments on the plan are included in the attached sheets.

In summary, KSCTWS feels that other alternatives should be considered which will reduce sediment loads and improve water quality. The relatively small amount of damage from natural floods does not justify such an expensive construction project.

Sincerely,

Tom Swan, President
KSCTWS

cc: KSCTWS Board

Response

1 The watershed concept not only addresses flood control but water quality as well. Planning for this project has resulted in a non-point source plan for Doyle Creek to address many of the concerns you address.

2 This concern was expressed by the Kansas Department of Wildlife and Parks. The response to this issue is repeated here for additional information.

This comment raises apparent conflicts between cropland reduction goals of the Conservation and Wetland Reserve Programs and cropland protection benefits available through P.L. 566. Congress passed laws making these programs available. The project sponsors have a right to apply for and receive benefits available through the Public Law 566 Watershed Program. This project has been formulated to meet P.L. 566 program requirements and other federal and state water policy. The SCS cannot arbitrarily deny benefits available through any one of the programs to satisfy philosophical concerns.

3 The system of dams will result in cleaner streams. Experience in other watersheds in the state shows stream flow is enhanced during dry times. Contrary to the opinion of some who feel a watershed project naturally results in changed land use of the flood plain, greater encroachment of cropland does not occur. Thirty-five years of watershed experience in Kansas indicates flood plain land use below dams remains relatively unchanged with a slight trend toward conversion to grassland. Residents of land in and around watershed dams state wildlife populations increase with project action.

4 Prime farmland includes upland and flood plain acres. The flood plain acres are those acres flooded between the 100-year and 2-year frequency flood. As dams retard flood water, the acres flooded at the 2-year frequency become less. This change in flooded acres is the new prime farmland. The increase is all from existing cropland and has no effect on grassland or forestland located on the flood plain.

5 Each listed specific comment was considered and appropriate changes made. Some comments were cited by the Kansas Department of Wildlife and Parks or the Kansas Department of Health and Environment and responses made in those sections.

APPENDIX B

SUPPORT MAPS

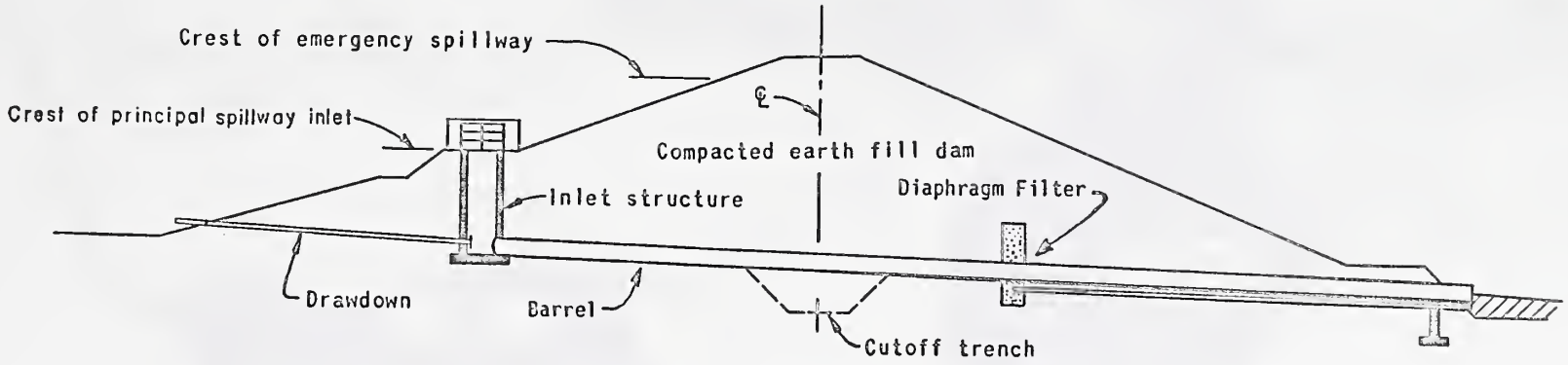
Typical Earth Dam with Drop Inlet Spillway

Cottonwood River Basin Map

City of Peabody Flood Hazard Map

SOIL CONSERVATION SERVICE

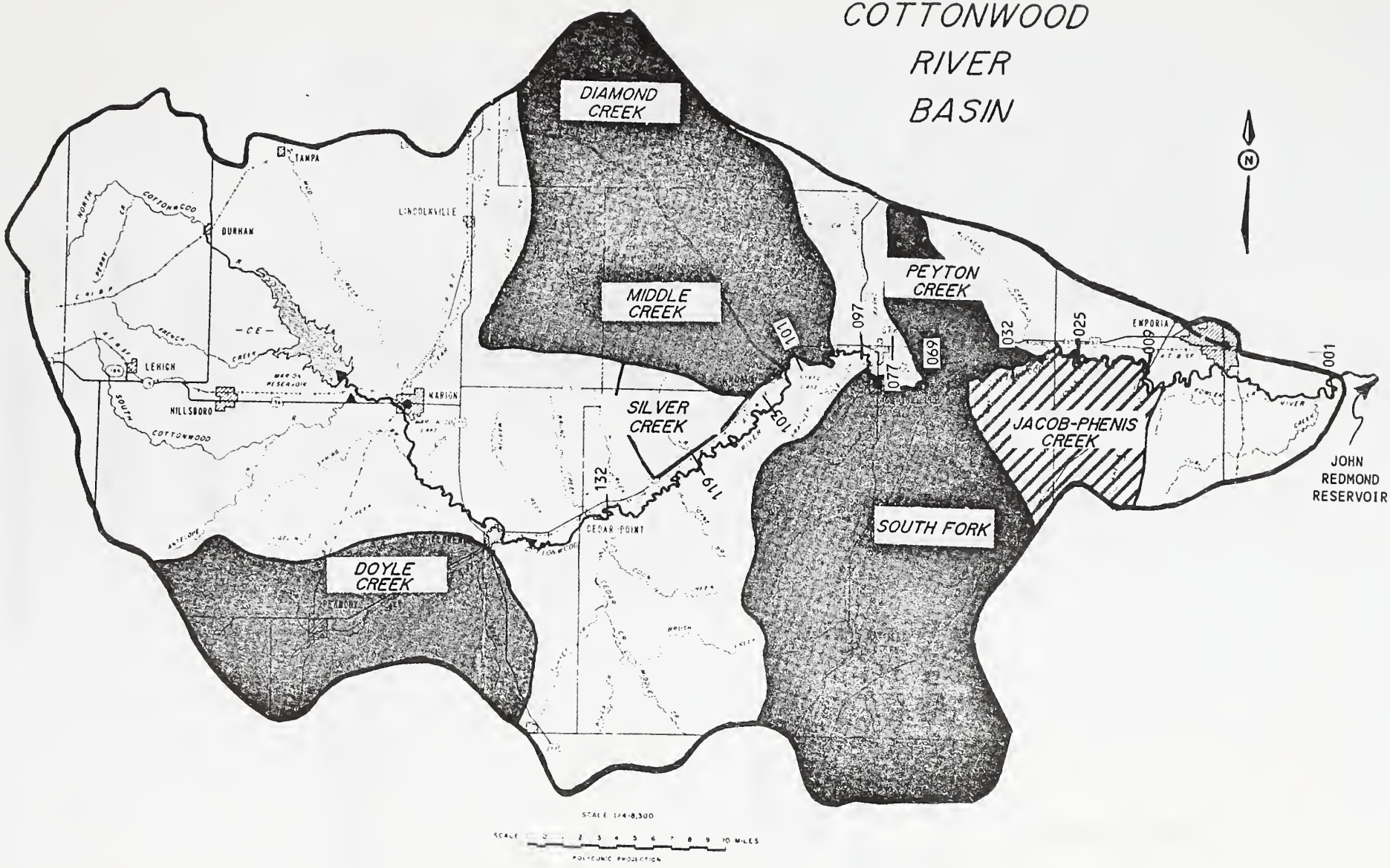
TYPICAL EARTH DAM WITH DROP INLET SPILLWAY

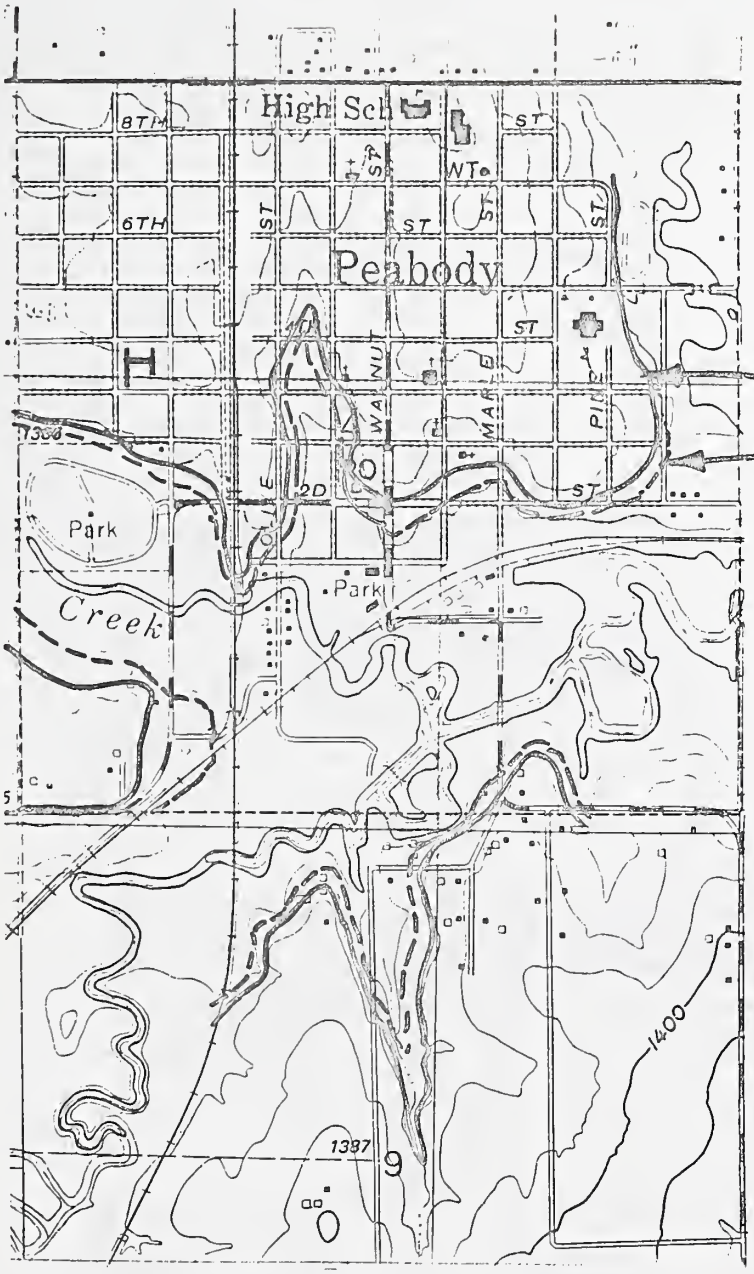


CROSS SECTION OF DAM ON CENTERLINE OF PRINCIPAL SPILLWAY

NOTES:

1. FOR INDIVIDUAL STRUCTURE DATA SEE TABLE 3.
2. EMBANKMENT AND FOUNDATION DESIGN FEATURES NOT SHOWN.


COTTONWOOD
RIVER
BASIN
DIAMOND
CREEK
MIDDLE
CREEK
PEYTON
CREEK
SILVER
CREEK
JACOB-PHENIS
CREEK
SOUTH FORK
DOYLE
CREEK
JOHN
REDMOND
RESERVOIR
TAMPA
LINCOLNVILLE
DURHAM
LEHIGH
HILLSBORO
MARION
CEDAR POINT
EMPORIA
101
097
077
069
032
025
009
001
102
119
132
N
SCALE 1:418,300
0 1 2 3 4 5 6 7 8 9 10 MILES
POLYCONIC PROJECTION



500-YEAR FLOOD

100-YEAR FLOOD WITHOUT PROJECT 1/

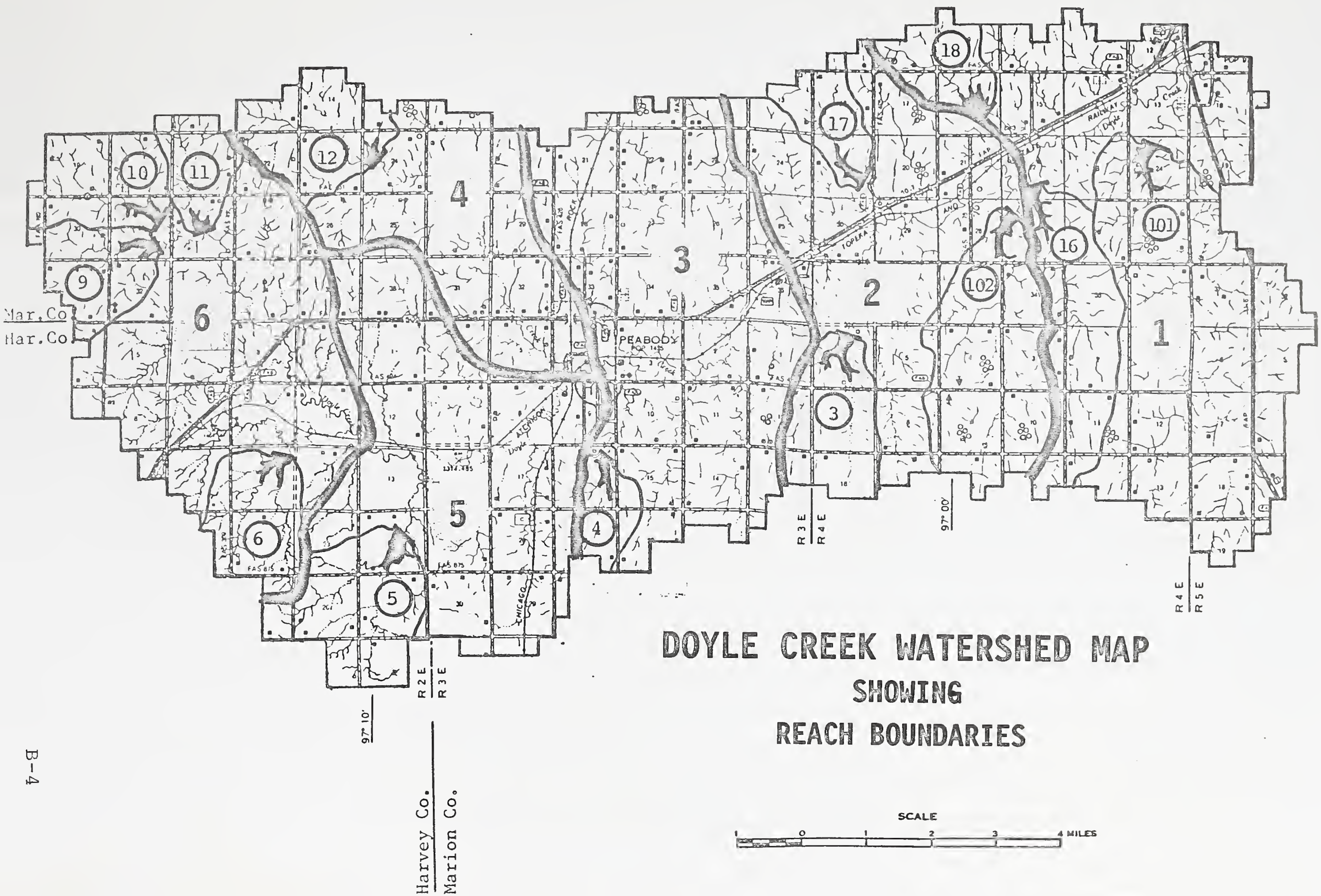
1/ The differences in with and without flood elevations are not great enough to distinguish on a map of this scale.

FLOOD HAZARD MAP

PEABODY, KANSAS

DOYLE CREEK WATERSHED

DOYLE CREEK WATERSHED MAP
SHOWING
REACH BOUNDARIES



A P P E N D I X C

SUPPORTING INFORMATION

TABLE I

WILDLIFE HABITAT UNIT LOSS FOR FLOODWATER STRUCTURES
BEFORE COMPENSATION

Site No.	Acres		Cropland		Pastureland		Rangeland		Riparian Forestland		Upland Forestland		Bank Zone		Water Zone		H.U. Potential in Dam and Spillway
	Dam & Splwy.	Sed. Pool	Acres	H.U.	Acres	H.U.	Acres	H.U.	Acres	H.U.	Acres	H.U.	Acres	H.U.	Acres	H.U.	
5	12	58	21.0	67.0	-	-	36.0	162.0	10.0	54.6	-	-	2.0	13.0	1.0	5.0	120
6	10	37	-	-	7.0	23.0	36.0	234.0	1.0	5.6	1.0	5.6	1.8	7.0	0.2	1.1	100
10	8	48	-	-	43.0	95.0	11.0	36.0	-	-	-	-	1.6	4.8	0.4	2.1	80
11	6	26	5.0	24.0	-	-	25.0	67.0	-	-	-	-	1.8	4.5	0.2	0.5	60
101	18	59	43.0	95.0	21.0	67.0	-	-	11.0	85.8	-	-	1.0	8.7	1.0	7.0	180
102	11	42	33.0	198.0	-	-	11.0	84.0	7.0	54.6	-	-	1.3	10.8	0.7	4.9	110
Total	65	270	102.0	384.0	71.0	185.0	119.0	583.0	29.0	200.6	1.0	5.6	9.5	48.8	3.5	20.6	650

January 1992

TABLE II

WILDLIFE HABITAT COMPENSATION ALTERNATIVES[a/]

Site No.	Habitat Units Lost		Habitat Units to be Compensated		Planting Acres to be Planted		Preservation Estimated Acres to be Preserved		Net Change Habitat Units
	Woodland	Herbaceous	Woodland	Herbaceous	Woodland	Herbaceous	Riparian Woodland	Based upon 10-R Value of	
5	72.6	229.0	72.6	120.0	9.0	12.0	17.3	4.2	- 109.0 H
6	11.2	265.2	11.2	100.0	1.4	10.0	2.7	4.2	- 165.2 H
10	-	137.8	-	80.0	-	8.0	-	-	- 57.8 H
11	-	96.5	-	60.0	-	6.0	-	-	- 36.5 H
101	101.5	161.8	101.5	180.0	12.7	18.0	24.2	4.2	- 18.2 H
102	70.3	281.6	70.3	110.0	8.8	11.0	16.7	4.2	- 171.6 H
Total	255.6	1,171.9	255.6	650.0	31.9	65.0	60.9		- 521.9 H

a/ Woodland compensation will likely be a combination of planting and preservation

January 1992

INVESTIGATION AND ANALYSIS

CONTENTS

TABLES

RATIONALE FOR PLAN FORMULATION

The Doyle Creek Watershed Board listed its watershed problems and objectives in the watershed application. The district board had a General Plan prepared, June 1975, which gave a dollar value for watershed damages and project benefits, as well as a list of potential dams with structure data and estimated construction costs. The watershed was assisted by the engineering firm Delamater, Freund, and Scherer, PA, and the Soil Conservation Service.

The watershed board wanted to reduce flood damages as much as possible. Several alternatives were evaluated which included varying numbers of dams resulting in different percent damage reduction benefits and varying acres benefitted.

A water quality plan was evaluated and results presented to the watershed board. They chose to implement the water quality plan using PL-566 and available state programs.

The board selected the six-structure NED plan as the alternative for which they had public support, anticipated donated land rights, and have finances available for construction, operation, and maintenance.

COST ALLOCATION

The watershed project was formulated for flood prevention and water quality. The dams were designed for sediment storage and floodwater detention. Water quality effects were incidental to flood damage reduction benefits; therefore, all dam costs were allocated to flood prevention. Riparian forestland improvement will enhance stream fishery, improve water quality, and increase farm income. Technical assistance was cost shared between federal and local costs, but enduring practices are to be cost shared by private and state funds with no federal funds involved.

ENGINEERING

Twenty-one floodwater retarding dams were identified by the Doyle Creek Watershed Board in its General Plan dated June 1975. Field examination, USGS 7-1/2 minute quadrangle topographic maps, and aerial photos were used in developing preliminary designs for the General Plan.

When PL-566 planning was subsequently begun by SCS, eighteen dams were chosen for further analysis.

Topographic maps with 4-foot contour interval, photographic background, and a scale of 1" = 300' were made by contract. Also contracted for were elevation-area-storage curves and field-run centerline profiles. All subsequent work was done by SCS with input from the Doyle Creek board.

A review was made of the eighteen dams for centerline and emergency spillway alignment with site efficiency and land rights needs in mind. Shifts in location and alignment were subsequently made on several of the dams.

Curve numbers and times of concentration were provided by the hydrologist. Drainage areas were recomputed and checked. Sediment storage requirements were computed by the geologist.

Reconnaissance-level geologic investigations were made by the geologist using field review and Kansas Geologic Survey data for Harvey and Marion Counties. No unusual problems with foundations or borrow materials are expected. Conditions are similar to those in previously constructed watershed projects in south-central and southeast Kansas.

Preliminary designs were made using the Dams2 computer program. TR-66 computer routings were made to establish approximate breach impact areas. Field reconnaissance and USGS quadrangle topographic maps were used to compile data and make hazard class judgments and provide documentation. Hazard classifications are subject to review and approval by the State Conservation Engineer.

A detailed construction cost estimate was made for each dam using 1989 unit costs based on averages of contract prices for recently constructed PL-566 dams in Kansas. Costs were later updated using 1990 costs.

Contingencies of 12 percent were included in construction costs. Engineering costs were estimated at 35 percent of construction costs. Project administration costs were estimated at 15 percent of construction costs. Installation costs were amortized at 8 3/4 percent for 100 years. Operation and maintenance costs were estimated at 0.48 percent of construction costs. Land rights costs were computed using land values supplied by the Doyle Creek Watershed Board.

Economic analysis showed six of the proposed dams to be economically feasible. They are included in the recommended plan.

An analysis of visual resources was made. It indicates that no significant impacts will be made by the proposed project in this rural agricultural area.

Land rights work maps with photographic backgrounds were developed. They show elevations of permanent pools, minimum required easements, emergency spillways, and tops of dams. Areas associated with each level for each landowner are tabulated on the maps.

BIOLOGY

The Kansas Fish and Wildlife Habitat Analysis Procedure, Part 580 of the National Biology Manual, was used for the Doyle Creek assessment. The Soil Conservation Service was responsible for leadership and scheduling of the assessment. Kansas Department of Wildlife and Parks and U.S. Fish and Wildlife Service provided aquatic and terrestrial biologists and specialized equipment, such as shocking equipment, nets, and a boat, to assist with the assessment. An aquatic and terrestrial wildlife habitat assessment was made for Dam Sites No. 5, 6, 10, 11, 101, and 102.

Specific amounts of mitigation required as a result of the assessment are found in Table II, Appendix C. Woodland mitigation required by Soil Conservation Service policy amounts to 31.3 acres.

An aquatic assessment was made July 16-20, 1990, at Dam Sites No. 101, 102, and 6. None of the 28 species collected were considered threatened or endangered.

The Soil Conservation Service completed a Biological Assessment of the Cottonwood Basin in April 1991. The purpose of the assessment was to present all available information related to the effects of existing and proposed P.L. 566 projects on threatened and endangered species with an emphasis on the Neosho madtom. The assessment was utilized to enter into formal consultation with the U.S. Fish and Wildlife Service.

HYDROLOGY

Doyle Creek is one of seven organized watershed districts in the Cottonwood River Basin. It has a drainage area of 139.71 square miles of the 1,908 square miles for the Cottonwood River Basin at the confluence with the Neosho River southeast of Emporia. Marion Lake, a Corps of Engineers dam, controls 200 square miles of Cottonwood River drainage area above its confluence with Doyle Creek.

With the number of organized watershed districts, as well as the Corps of Engineers' dam, a system of allotting off-site benefits needed to be developed. In the fall of 1979, SCS and the Corps of Engineers agreed on the procedure to distribute flood damage reduction benefits on a fair-share basis.

The WSP2 and TR20 computer models were used to analyze Doyle Creek and the Cottonwood River Basin. The WSP2 model was used to process surveyed valley cross section data and channel and flood plain lengths to compute discharges in cubic feet per second at different elevations in the stream channel and flood plain. The output is known as a rating table and all cross section elevations are tied to mean sea level. The TR20 model was used to evaluate the runoff from different rainfall volumes and route the runoff through the rating tables from the WSP2 model. Using these models the following procedure was used to analyze the basin:

Uniform storms of 2, 4, 6, 8, and 10 inches were used in TR-20 to calculate discharges from the basin. These storms were applied both with and without total project development in the basin. First and last increment TR-20 computer runs were made with the various watersheds in the basin. This analysis showed the "with project" discharges from watersheds located in the lower part of the basin were increasing the "uncontrolled" upstream peak rather than reducing it when using large uniform storms. This condition can occur, but a more common occurrence is a localized storm in one part of the basin which causes flooding on a small part of the Cottonwood River. This event occurs more frequently than a large uniform storm over the whole basin.

In order to analyze this second condition, three (3) separate synthetic storm conditions were run to find discharge-frequency points. Base storms of 2, 4, and 6 inches were used with all the projects installed to make last increment routings. An 8- or 10-inch storm was placed on each watershed both with and without projects to determine its peak reduction in each downstream reach. The total peak reduction for each reach was calculated using contributing watershed peak reduction data. A direct percent reduction for each watershed was computed and tabulated using the total peak reduction. This synthetic storm combination produced discharges in the 2-, 10-, and 70-year frequency ranges. Percent reduction and frequency for each of the synthetic storms were used to plot curves to compute average annual frequency and percent reduction. The average annual data were computed using a weighted factor method. The computed "Percent Reduction" figures were adjusted to get a 100 percent total for each reach. The adjusted "Percent Reduction" values will be used to allocate mainstem benefits back to the individual watersheds.

This method of analysis gives more consideration to the lower frequency events which cause damage on the mainstem. These events account for most of the benefits realized on the mainstem. This analysis also gives more

consideration to the watersheds in the lower part of the basin. Benefits are realized from these watersheds when storms are centered over the lower part of the basin.

Historical storms were analyzed in conjunction with the synthetic storms. A discharge from Cedar Creek Watershed equivalent to a 90-year frequency storm only produced a discharge on the mainstem equivalent to a 6-year frequency storm. A discharge from South Fork Watershed equivalent to a 100-year frequency storm only produced a discharge on the mainstem equivalent to a 15-year frequency storm. These localized storms are more likely to occur in the basin than a uniform storm over the whole basin.

Table AA shows the distribution of flood damage reduction benefits to each watershed within the basin.

The Cottonwood River Basin Map shows the relationship of this watershed to others within the basin (see Appendix B). Mainstem cross sections are listed on the map for reference and are situated at the end of specific flood plain reaches. Compare Table AA and the basin map for more detail.

TABLE AA - DISTRIBUTION OF COTTONWOOD RIVER MAINSTEM BENEFITS

Mainstem Cross Section No.	Reach 1/	Percent of Total										
		Doyle Creek	Cedar Creek	Mud & Clear Creeks	South Cottonwood	Martin, Bruno, & French Crks.	Middle Creek	Diamond Creek	Fox Creek	South Fork	Jacob-Phenis Creeks	Peyton Creek
132	27	41.1		22.6	36.3							
119	25	24.5	39.8	12.8	22.9							
103	21 & 23	25.6	39.8	11.9	22.7							
101	19	20.2	30.0	11.0	18.0		20.8					
097	17	16.1	23.5	8.5	13.9	0.6	14.4	23.0				
077	15	15.2	22.4	7.6	13.6	1.5	13.6	22.8	3.3			
069	13	15.1	22.1	7.8	14.5	2.9	13.0	22.5	2.1			
032	10 & 7	12.4	17.7	5.9	11.2	1.8	10.8	18.3	0.4	19.7		1.8
025	5	12.2	15.5	6.0	10.5	2.7	8.3	16.3	0.4	26.6		1.5
009	3	11.9	11.3	7.3	9.5	3.6	3.6	9.8	0.4	40.5	0.6	1.5
001	1	12.0	11.3	6.7	9.5	3.6	3.7	10.0	0.3	39.9	1.5	1.5

1/ The basin map shows cross section numbers which are located at the bottom of corresponding reaches for reference. Reach numbers and flood plain widths are not shown.

The watershed hydraulic and hydrologic analysis was based on sample data. Twenty-five valley cross sections, 14 road and bridge profiles, and 6 railroad and bridge profiles were surveyed. Time of concentrations was computed for each dam and subarea using the velocity equation method.

A statistical analysis was done to select the number of samples needed to compute curve numbers. Fifty 160-acre tracts were selected with nine in each of five reaches and five samples in reach 4. The sample area curve numbers for each reach were added together and divided by the number of samples to establish a reach curve number. The reach curve number was used for all dams and subareas of that reach.

To check the accuracy of computing curve numbers based on a 10 percent sample, a 100 percent land use analysis was made on the drainage area of three dams with each in a different reach. The difference in the average CN for the reach and that for the dams were insignificant. Therefore, the average reach CN were used for this watershed analysis.

It was agreed to make topographic maps for Dams No. 4, 6, 9, 10, 11, 101, and 102 and prepare more accurate cost estimates referred to as preliminary design cost estimates. At the same time, flood damage reduction benefits were evaluated for this system of dams using square miles controlled by reach within the watershed. It was decided to evaluate the dams in different combinations and then select the best combination for the NED plan.

The 10-year frequency storm of 5.3 inches of rainfall was used to predict the effect each dam would have. The dams were grouped together for the following alternatives:

Alt. 12 - future without project conditions
Alt. 30 - future with Dams No. 6, 9, 10, 101, and 102
Alt. 31 - future with Dams No. 6, 9, 11, 101, and 102
Alt. 32 - future with Dams No. 6, 10, 11, 101, and 102
Alt. 33 - future with Dams No. 6, 9, 10, 11, 101, and 102
Alt. 34 - future with Dams No. 4, 6, 9, 10, 11, 101, and 102
Alt. 35 - future with Dams No. 4, 6, 9, 10, 11, 12, 101, and 102
Alt. 36 - future with Dams No. 4, 6, 10, 11, 101, and 102
Alt. 37 - future with Dams No. 4, 5, 6, 10, 11, 101, and 102
Alt. 38 - future with Dams No. 5, 6, 10, 11, 101, and 102
Alt. 50 - future with Dams No. 3, 4, 5, 6, 9, 10, 11, 12, 16, 17, 18, 101, and 102

It did not make any difference whether Alternative 30, 31, 32, or 33 was used, the discharges from valley cross section 6-1 to 1-1 were approximately the same. Alternative 33 had the largest peak reduction on cross sections 6-2 to 6-5. The other alternatives were approximately equal. Alternative 34 has Dam No. 4 added to Alternative 33 and shows some peak reduction to cross sections 3-4 to 1-1.

Alternative 35 has Dam No. 12 added to Alternative 34 and shows some peak reduction to cross sections 4-2 to 1-1. Alternative 36 is the same as Alternative 34 minus Dam No. 9 and it shows the same peak reduction as Alternative 32 for valley cross section 6-5 to 3-5. Dam No. 4's peak reductions are for cross sections 3-4 to 1-1. Alternative 37 is the same as Alternative 36 with Dam No. 5 added and it shows significant peak reductions for valley cross sections 5-3 to 1-1. Some of these alternatives were not analyzed in detail because the cubic feet per second discharge changes were relatively insignificant; therefore, flood damage reduction benefits would be too small to justify incremental costs.

GEOLOGY

Ephemeral erosion was determined by using aerial photos and published soil survey bulletins to determine ephemeral lengths by soil type. Field investigations and interviews with district conservationists were used to help determine average widths and depths.

Gully erosion was defined by using aerial photos of the sample sites. Basic information included aerial photos and soil survey maps. Sample worksheets provided information to estimate gully lengths and widths. Judgment was used to determine erosion rates by using vegetation and distance of head cuts relative to stable points in time.

Streambank erosion was determined by worksheet information and verified by field trips. Judgment was used to determine lateral erosion rates from root exposure, slumping, and other erosion features.

Scour determinations were made by using aerial photos to delineate channel and sheet scour. These acres were correlated with Econ2 information on acres flooded. Field interviews were made to determine farmer's perception of the extent of scouring. Surveyed hydrology valley and channel cross sections were used to determine depth and width of scour areas. SNTC TG-12 was used as a reference in determining percent damage by depth and width.

Sediment yields were determined by developing sediment delivery ratios (SDR) from knowledge of the area, Bulletin No. 16 which contains SDR information based upon over 150 sediment surveys of ponds and lakes in Kansas and modifications or fine tuning by noting distance to outlet, topography, and distance to a water course. Judgment and logical interpretation of potential or relative deliveries for different erosion types helped to develop delivery ratios for ephemeral, gully, scour, and streambank erosion.

Table BB shows erosion by type for present, future without, NED, and water quality. Table CC shows the sediment

yield by type for present, future without, NED, and water quality.

Table BB - Erosion by Source
(tons per year)

Type	Present	Future Without	NED	Water Quality
Sheet and Rill	194,200	154,090	154,090	136,000
Ephemeral Gully	69,900	36,900	36,900	19,600
Gully	5,300	5,200	4,700	4,000
Stream Bank	32,700	29,660	26,700	25,300
Flood Plain Scour	9,900	9,750	8,800	8,500
Total	312,000	235,600	231,190	193,400

Table CC - Sediment Yield by Source
(tons per year)

Type	Present	Future Without	NED	Water Quality
Sheet and Rill	41,800	35,900	27,000	19,600
Ephemeral Gully	46,800	24,700	22,700	6,300
Gully	4,300	4,500	2,300	2,200
Stream Bank	29,600	28,100	19,500	15,300
Flood Plain Scour	9,000	9,000	7,600	7,500
Total	131,500	102,200	79,100	50,900

A sediment budget was prepared to track and verify the sediment traps and their interrelationship to off-site yields. Future land treatment including on-going, CRP, and other land use changes and selected dams were used to estimate sediment yields for all alternatives.

Table DD - Sediment Deposition

	Alternative 1 (future w/o)	Alternative 2 (NED)	Alternative 3 (WQ)
Ponds	7,400	6,500	6,800
Ditches	27,900	20,000	18,800
Flood Control Structures	6,500	25,300	29,200
Stream	2,800	3,800	2,700
Terraces	19,300	20,000	24,100
Other Land Treatment	3,200	7,200	6,200
Stay on Fields	65,100	67,900	55,100
Flood Plain	800	400	300
Out of Watershed (John Redmond)	93,100	80,900	49,900

A rationale and methodology section was developed to relate the effects of individual and systems of conservation practices to water quality. The basic premises were: good information is known about sediment movement and deposition; individual pollutants relate to the movement and deposition of sediment; much is known about the trap efficiency on sediment by various conservation practices; therefore, sediment is used as the "indicator" for the effects of conservation practices on pollutants.

RESOURCE INVENTORY

A decision was made to inventory a sample of the watershed to determine land use, soils, land treatment, and collect the basic data to compute sheet and rill erosion. The MNTC was contacted about developing a statistical sample. At a multidisciplinary staff meeting, the accuracy of a sample was discussed and the meeting concluded with a decision to conduct a 10 percent sample.

The southeast part of the watershed has a consistent soil association and a high percentage of grassland. It was agreed that this area would not require a 10 percent sample. Sample areas were stratified by township and range as a tool to ensure distribution throughout the watershed and for all reaches. After drawing the sample, the distribution was reviewed to ensure adequate coverage. Several additional samples were randomly selected to satisfy this need.

Land Use: Land use was determined by a field visit and the use of aerial photography by the Planning Staff's soil conservationist. Field sizes were measured. The size of crop fields were correlated with ASCS measurements. Samples were compiled and checked to meet 160 acres or the ASCS acreage.

Soils: Soils were identified from the Harvey and Marion County Soil Surveys for each sample area. Acres by soil type for each field were measured and adjusted to equal the sample total acres.

Sheet and Rill Erosion: USLE factors were determined from the field inventory of soils, land treatment, residue amounts, and land cover. Crop rotations and crop residue levels were established by field review and with the district conservationists. Soil slopes and slope lengths were taken from the SCS Field Office Technical Guide (FOTG) and verified by field observations.

Highly Erodible Land: The amount of highly erodible land (HEL) soils was determined from the 10 percent sample. Later digitized soils data became available through the SCS Geographic Information System (GIS). The GIS-generated

numbers verified the sample number. HEL field data were gathered from the SCS field offices also through their CAMPS reporting system. The CAMPS totals compared well with the 10 percent sample.

Wetlands: The FOTG indicated that several hydric soils occurring in Harvey County were caused by seasonal flooding. Soils mapped in the watershed were checked for hydric soils. None of the soils identified as being hydric due to seasonal flooding exist in Doyle Creek Watershed. Through the FSA process, two wetlands in or adjoining cropland fields were determined to exist in the Marion County portion of the watershed. Several isolated wetlands occurring on grassland were seen within the watershed during the planning process. Soils in these wetland areas were hydric because of saturation from groundwater.

WATER QUALITY

The waters of Doyle Creek are typical of Kansas streams within this area. Little published water quality data are available. This situation led to an agreement in 1988 between SCS and Kansas Department of Health and Environment (KDHE) to monitor Doyle Creek.

A literature search was used to determine effects of various conservation practices on various pollutants. Reason and judgment were used to determine effects of systems of practices on individual pollutants. District conservationists determined what standard, acceptable county practices systems were used by slope group to reduce erosion. Weighted effects of these systems were used to determine the overall effects on water quality.

SCS helped KDHE monitor base line and runoff water quality parameters. KDHE tested the samples, made interpretations, and wrote an assessment report containing conclusions and recommendations. These recommendations included percent reductions of each pollutant needed to meet the state water quality standards. This report formed the basis for formulating the water quality plan.

The pollutants analyzed were sediment, phosphorus, and nitrogen. Fecal bacteria was analyzed similar to nitrogen/phosphorus because bacteria are highly mobile in water and some will be attached to the sediment. Individual practices and systems of practices were weighted as to their effects on pollutants.

KDHE established a monthly monitoring site near the mouth of Doyle Creek in January 1989. In the spring of 1989 SCS installed an automatic water sampler upstream to monitor runoff flows. KDHE agreed to analyze all water samples and interpret water quality tests.

Sampling began at the automatic sampler during May 1989. Between May and July 1989 the automatic sampler collected composite samples from four runoff events. See the Doyle Creek Preliminary Water Quality Assessment, 1990, for more details.

The overall mean pollutant concentrations were calculated using the baseflow and runoff means along with the estimated fraction of the time the creek carries baseflow and runoff flows. The baseflow occurred about seven-eights of the time and runoff one-eighth of the time (45 days per year). These relationships are typical of a stream the size of Doyle Creek in central Kansas.

Feedlots were considered separately due to their uniqueness. Little is known about the movement of fecal bacteria and the trapping of bacteria by conservation practices. Judgment was used to develop a reasonable method to estimate the effects of conservation practices on confined feeding areas. A field investigation was conducted that divided the areas into good, fair, and poor facilities relative to its potential influence to water quality. Some of the factors used were distance to a stream, stream type, topography, number and kind of animal, presence of treatment, and foreign water through the feedlot. Several practices and a system of those practices were used to reduce the level of feedlot pollutants, primarily fecal bacteria. These included cover crops, filter strips, diversions, lagoons, and management such as manure management, and moving the site.

ECONOMICS

WATERSHED

Flood Damages: Econ2 and the land damage computer programs were used to evaluate flood damages. About 30 flood plain farmers were interviewed and provided flood plain land use, flood-free crop yields, and historical damages other than crop for two historical storms. The hydrologist determined the discharge and frequency of these storms and beginning flood damage. A damage curve was drawn between the three points and extended to reflect the 100-year discharges.

County road engineers were interviewed and provided the damage factors for road and bridge damage evaluations. Beginning road and bridge damage elevations, depths of flooding, and width of flooding were computed by using the WSP2 computer program.

Retired railroad workers and local contractors were interviewed regarding historical railroad flood damages.

Every home in Peabody was re-appraised in 1989. These home values and personal interviews were used to evaluate

urban flood damages. Historical flood damages were estimated for two historical storms for homes and businesses and updated to 1990 and provided the basic data to draw a damage curve. Discharge and damages were taken off this curve and posted as urban cross sectional data in the ECON2 program.

Erosion: Two soil types were selected to measure erosion damages from untreated cropland. These evaluations were made for sheet and rill erosion, ephemeral erosion, and current erosion. Current crop yields, 1990 current normalized prices, soil erosion phases, physical inventories, and interest rates were used to evaluate and discount damages to a current base.

Water Quality: Water quality effects were analyzed and estimated for Doyle Creek and John Redmond Reservoir. The Kansas Department of Health and Environment tested Doyle Creek water and described the level of treatment needed for the water to meet the state water quality standards. Sediment, phosphorous, and fecal bacteria were the major pollutants. KDHE determined that these pollutants impaired Doyle Creek's aquatic life and contact recreation. Benefits for improvement in the stream were based on the change in stream sediment loads. Basic fishery data developed by Kansas Department of Wildlife and Parks were used to evaluate project effects.

The watershed has approximately 60 miles of perennial streams. Potential stream fishing is limited to the stream between Peabody and Florence which is about 17 miles and the Cottonwood River. Doyle Creek supplies 14 percent of the sediment load at the Plymouth gage about 65 miles downstream from the Doyle Creek confluence. For this analysis it was estimated that Doyle Creek would increase the fishing potential by 10 percent or 4 fisherman per year for the 128 mile river length. It was estimated that fisherman per year would increase by 13 persons per year for the 17 miles of Doyle Creek.

OFF PROJECT

John Redmond Reservoir: The beneficial effects of reducing sediment entering John Redmond Reservoir was done in two steps. Step one involved extending all lake purposes for about 13 years for all PL-566 watersheds and 3 years for Doyle Creek. Benefits were discounted at 8 3/4 percent interest. Step two involved the altering of recreational use by slowing the rate of sediment deposited in the lake. The unit day value method was used and the beneficial affects were discounted to reflect the evaluation period.

Cottonwood River: Doyle Creek Watershed is one of seven PL-566 watersheds in the Cottonwood River Basin that drains into John Redmond Reservoir. These watersheds include Doyle

Creek, Middle Creek, Diamond Creek, Peyton Creek, South Fork, Silver Creek, and Jacob-Phenis Creek. There are other watersheds that drain into John Redmond but are not organized as PL-566 watersheds. Marion Lake, in the upper end of the basin, controls about 200 square miles.

Early in planning, it became apparent that installation of PL-566 dams would have a major affect on the Cottonwood River flooding. The problem was as how to allocate flood damage reduction benefits on a fair-share basis. Preliminary analysis illustrated each watershed was capable of flooding the Cottonwood River flood plain.

Representatives from the Corps of Engineers and SCS developed a procedure to distribute flood damage reduction benefits to each watershed. The steps involved are discussed in more detail in the hydrology section. Table AA shows the distribution for those watersheds involved.

The Cottonwood River flood plain below Doyle Creek confluence totals about 50,000 acres. Table EE shows the flood plain acres by reach, total, and average annual for present, future, and future with project conditions.

The flood plain land use consists of 30 percent wheat, 24 percent grain sorghum, 15 percent corn, 12 percent soybeans, 8.2 percent woodland, 6 percent pasture and rangeland, 2.7 percent alfalfa, 2 percent miscellaneous, and 0.1 percent silage sorghum. Several small towns have developed on the flood plain. Emporia, Cottonwood Falls, and Marion are the largest.

About 121 miles of dirt, gravel, and asphalt roads are located on the flood plain. The lengths and depths flooded were derived from the Corps of Engineers' basic data. Per foot of damage by depth were based on data developed for Diamond and Middle Creek watersheds.

There are about 29 miles of railroad located on the flood plain. Length of flooding by depths was taken from the Corps of Engineers' basic data reports. Unit damage estimates came from SCS data sources.

Table EE - Cottonwood River Flood Plain by Reach

Reach	Present (acres)	Future With-out Project (acres)	Future with Project (acres)
1	14,891	14,815	13,850
3	6,623	6,618	6,557
5	4,140	4,139	4,061
7	1,619	1,612	1,442
10	2,197	2,195	2,124
13	1,849	1,846	1,795
15	1,220	1,218	1,172
17	4,089	4,088	4,027
19	1,398	1,398	1,358
21	2,555	2,550	2,495
23	1,804	1,803	1,797
25	3,658	3,653	3,534
27	4,028	3,957	3,724
Total	50,071	49,892	47,936
Average Annual	55,236	39,353	27,020

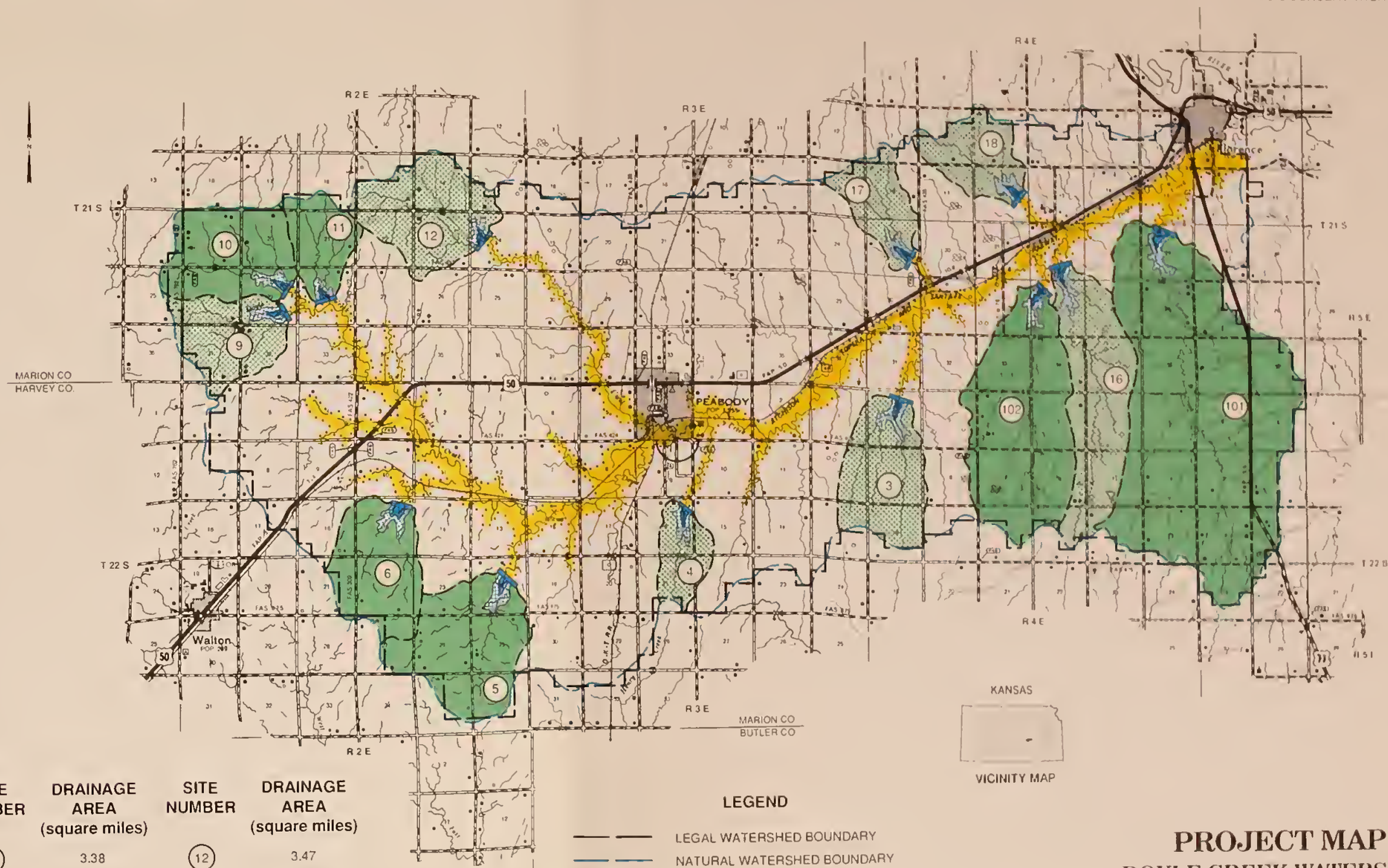
The Corps of Engineers developed an urban flood damage curve for rural and urban areas based on 1967 dollars for use in evaluating Marion and Cedar Point Reservoirs. These damage curves were updated and used for the analysis of Diamond Creek, Middle Creek, Peyton Creek, South Fork, Jacob-Phenis Creek and Doyle Creek. The basic data were updated to fit the price base of the watershed being evaluated. These data were updated to the 1990 price base for evaluation of Doyle Creek watershed.

A P P E N D I X D

PROJECT MAP

U.S DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE



SITE NUMBER	DRAINAGE AREA (square miles)	SITE NUMBER	DRAINAGE AREA (square miles)
3	3.38	12	3.47
4	1.21	16	4.86
5	4.46	17	1.79
6	2.95	18	2.01
9	2.30	101	15.80
10	3.02	102	6.80
11	1.60		

SOURCE DOT General highway maps of Harvey and Marion Counties Information from USDA Soil Conservation Service
Polyconic projection

LEGEND

- LEGAL WATERSHED BOUNDARY
- NATURAL WATERSHED BOUNDARY
- DRAINAGE AREA CONTROLLED BY PL-566 FLOODWATER RETARDING STRUCTURES
- DRAINAGE AREA CONTROLLED BY STATE-FUNDED DETENTION DAMS
- AREA BENEFITED
- FLOODWATER RETARDING STRUCTURE
- SEDIMENT STORAGE POOL
- FLOODWATER RETARDING STORAGE POOL

KANSAS

VICINITY MAP

PROJECT MAP

DOYLE CREEK WATERSHED

HARVEY AND MARION COUNTIES
KANSAS

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